THE

INTELLECTUAL OBSERVER:

REVIEW OF NATURAL HISTORY,

MICROSCOPIC RESEARCH,

AND

RECREATIVE SCIENCE.

VOLUME V.

ILLUSTRATED WITH PLATES IN COLOURS AND TINTS, AND NUMEROUS ENGRAVINGS ON WOOD.

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CONTENTS.

PAGE.

A New British Fungus. By the Rev. M. J. Berkeley, M.A., F.L.S. *With a Coloured Plate* 1

Observations on the Three-spined Stickleback—Its Ova and Fry. By J. H. Horsfall. *With an Illustration* 4

The Mosses Anacalypta and Pottia. By M. G. Campbell 8

A Windfall for the Microscope. By the Hon. Mrs. Ward. *With a Coloured Plate* 13

Minstrels of the Winter. By Shirley Hibberd 17

Salt Marshes and their Inhabitants. By George S. Brady, M.R.C.S. 26

Optical Ghosts 34

The Ruins of Copan 38

Results of Meteorological Observations made at the Kew Observatory. By G. M. Whipple 40

We never See the Stars 47

Green Ice. By Henry J. Slack, F.G.S. 51

Clusters and Nebulæ. Double Star. Great Nebula in Orion. Comparison of Sun and Stars. Occultation. By the Rev. T. W. Webb, M.A., F.R.A.S. *With a Diagram* 54

The Dentition of British Mollusca. By the Rev. G. Rowe, M.A. *With a Tinted Plate* 67

Automatic Weighing of Gold and Silver Planchets at the Royal Mint. By Joseph Newton. *With an Illustration* 72

The Earthquake at Mendoza, 20th March, 1861. By William Bollaert. *With a Tinted Plate* 85

The Midnight Sun. By Thomas W. Burr, F.R.A.S., F.C.S. 95

Mosses—Grimmia and Schistidium. By M. G. Campbell. *With an Illustration* 106

Guns and Projectiles 113

Aerolites with Low Velocities 123

The Wind and its Direction. By E. J. Lowe, F.R.A.S., F.L.S. *With Illustrations* 125

Constancy of Solar Light and Heat. By Alexander S. Herschel, B.A. 129

Insanity and Crime 131

Clusters and Nebulæ. Double Stars. Occultations. By the Rev. T. W. Webb, M.A., F.R.A.S. 138

Egg Parasites and their Relatives. By the Rev. M. J. Berkeley, M.A., F.L.S. *With a Tinted Plate* 147

Photography—Its History, Position, and Prospects. Part I. By J. W. M'Gauley 153

Ozone and Ozone Tests. By E. J. Lowe, Esq., F.R.A.S., F.G.S., etc. ... 160

Portable Equatoreals. By William C. Burder, F.R.A.S. 166

On the Ancient Lake Habitations of Switzerland. By Henry Woodward, F.Z.S. *With a Tinted Plate* 170

Voracity of the Asplanchna, and its Stomach Currents. By Henry J. Slack, F.G.S. 182

The Foundations of Physical Science 185

The Moon. Planets of the Month. Double Star. Occultations. By the Rev. T. W. Webb, M.A., F.R.A.S. 193

The Extinguisher Mosses. By M. G. Campbell 207

Our Atmosphere and the Ether of Space 211

Anchoring Mollusks. By W. Newton Maccartney 215

PAGE.

THE NATTERJACK TOAD IN IRELAND. By the HON. MRS. WARD. *With a Coloured Plate* 237
PHOTOGRAPHIC PROCESSES. By J. W. M'GAULEY 233
A CHEAP OBSERVATORY. By FREDERICK BIRD. *With Illustrations* 241
CYCADS. By JOHN R. JACKSON. *With a Tinted Plate* 246
DISCOVERY OF POISON ORGANS IN FISHES. Communicated by HENRY WOODWARD, F.Z.S. 253
MOSSES TO BE FOUND IN MAY—CORD-MOSSES AND APPLE-MOSSES. By M. G. CAMPBELL 258
MOLECULAR MOTIONS IN LIVING BODIES. By HENRY J. SLACK, F.G.S. ... 269
THE PHOSPHATES USED IN AGRICULTURE. By DR. T. L. PHIPSON, F.C.S., LONDON 273
SNOW CRYSTALS. By E. J. LOWE, Esq., F.R.A.S. *With Illustrations* 279
RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE KEW OBSERVATORY. By G. M. WHIPPLE 284
STAR-FOLLOWING WITH TABLE STANDS. By Rev. E. L. BERTHON, M.A.... 290
SOLAR OBSERVATION. TRANSIT OF JUPITER'S SATELLITES. By the Rev. T. W. WEBB, M.A., F.R.A.S. 292
THE CADDIS-WORM AND ITS HOUSES. By ELIZABETH MARY SMEE. *With a Coloured Plate* 307
KEW OBSERVATORY 318
THE EARTH AS SEEN FROM THE MOON 324
RECENT MICROSCOPIC LITERATURE 328
EXOGENOUS SEEDS AND FERN SPORES. By R. DAWSON, M.B. LONDON. *With a Tinted Plate* 333
STAR FOLLOWING. By Rev. E. L. BERTHON, M.A. *With an Illustration* 338
A SUPPOSED NEW ACINETA. By H. J. SLACK, F.G.S. *With an Illustration* 340
GAUTIER ON THE PHYSICAL CONSTITUTION OF THE SUN 345
THE DIDUNCULUS, OR LITTLE DODO. By W. B. TEGETMEIER 346
RECREATIONS IN NATURAL HISTORY 351
THE FUNCTIONS OF ART 356
NEIGHBOURHOOD OF THE LUNAR SPOT, MARE CRISIUM. JUPITER'S SATELLITES. OCCULTATIONS. By the Rev. T. W. WEBB, M.A., F.R.A.S... 359
COMETS. AN ACCOUNT OF ALL THE COMETS WHOSE ORBITS HAVE NOT BEEN CALCULATED. BY G. F. CHAMBERS 218, 373
ON THE HERRING. By W. NEWTON MACCARTNEY, COR. SEC. G. N. S. ... 368
THE NATURAL HISTORY OF THE HAIRY-BACKED ANIMALCULES (CHÆTONOTIDÆ). By PHILIP HENRY GOSSE, F.R.S. *With Two Plates* 387
THE FOUR-HORNED TRUNK FISH: A NATIVE OF ENGLAND. By JONATHAN COUCH, F.L.S., ETC. 407
THE SIDE-FRUITING MOSSES. By M. G. CAMPBELL. *With an Illustration*... 410
FACTS ABOUT IRON 419
THE REMARKABLE WEATHER OF THE EARLY SUMMER OF 1864, AT THE HIGHFIELD HOUSE OBSERVATORY. By E. J. LOWE, ESQ., F.R.A.S., ETC. 425
MAGNUS ON THE CONDENSATION OF VAPOURS 432
SOLAR OBSERVATION. COLOURS OF STARS. CONSTITUTION OF NEBULÆ. TRANSITS OF JUPITER'S SATELLITES. By the Rev. T. W. WEBB, A.M., F.R.A.S. 434
THE ROMSEY OBSERVATORY. By the Rev. E. L. BERTHON. *With Illustrations* 445
ON THE ORIGIN OF THE LIGHT OF THE SUN AND STARS. By BALFOUR STEWART, M.A., F.R.S. 448
LITERARY NOTICES 375, 455
PROCEEDINGS OF LEARNED SOCIETIES 62, 141, 221, 299, 380, 457
NOTES AND MEMORANDA 64, 145, 225, 304, 383, 465

ILLUSTRATIONS.

ILLUSTRATIONS IN COLOURS.

	PAGE
Tremella nostoc, Chironomus plumosus, Phryganea grandis, etc.	13
Natterjack Toad	227
Cases of the Caddis-worm	307

TINTED PLATES.

Sparassis crispa, Rhizina undulata	1
Palates of Mollusca	67
Ruins of Mendoza	85
Egg Parasites	147
Implements and Ornaments found on the Sites of Ancient Lake Dwellings	170
Cycads	246
Germination of Fern Spores	334
Hairy-backed Animalcules (Pl. I.)	394
„ „ „ (Pl. II.)	402

ENGRAVINGS ON WOOD.

Three-spined Stickleback	4
Anacalypta Starkeana	8
Nebula in Orion	59
Weighing Balance used at the Mint	73
Grimmia orbicularis	107
Atmospheric Recorder	126, 127, 128
Index Map of Moon	190
Diagram of portion of Moon's Disc	197
Encalypta vulgaris	207
Cheap Observatory	243
Snow Crystals	281
Star Following	338
Supposed new Acineta	341
Silk-spinning Gnat	353
Faggots for Propagating Oysters	354
Breeding Troughs for hatching eggs of Crustacea	355
Four-horned Trunk Fish	407
Fontinalis antipyretica	410
Romsey Observatory	444
Diagrams of Spots on the Sun	450

1. Sparassis crispa. 2. Rhizina undulata.

THE INTELLECTUAL OBSERVER.

FEBRUARY, 1864.

A NEW BRITISH FUNGUS.

BY THE REV. M. J. BERKELEY, M.A., F.L.S.

(*With a Coloured Plate.*)

THOUGH so much has been done since the conclusion of the Cryptogamic part of the English Flora in 1837 towards forming a perfect list of British Fungi, the experience of the present abnormal season shows that there still remains much to reward diligent research. Not only has Mr. Broome, amongst other novelties, added to our list almost all the curious and beautiful species of Ascobolus described by the Messrs. Crouan, of Brest—a dung-borne genus distinguished by the curious property of partially ejecting the little sausage-like sacs, or asci, which contain the sporidia—while Wales and Scotland have made some welcome additions to our list; but the Rev. G. H. Sawyer has shown that many of the nobler forms which adorn the pine forests of the Continent may still be expected to occur in the more southern districts. In company with *Hydnum imbricatum*, one of the most striking of British fungi, though a rare inhabitant of our fir woods, he finds an equally large species, *Hydnum lævigatum*, together with the beautifully tinted *Hydnum tomentosum, and H. zonatum*, of which the two former are new to this country; and, in addition to these, *Rhizina undulata*, equally novel and remarkable for its fine fruit, of which, together with the plant itself, we give a sketch. But, besides these objects of interest, and others which we refrain from enumerating, he has contributed to our Fungology the genus *Sparassis*, a genus so striking that Fries declares that *Sparassis crispa*, the species which has occurred near Maidenhead, is the most beautiful of all the fungi he has ever seen. Without pledging our taste quite so far, we consider the object so beautiful, in addition to its

superior esculent qualities, that it seems worthy of an especial notice in the INTELLECTUAL OBSERVER.

Most of our readers are acquainted with the little tufts of white, cylindrical bodies, which occur in profusion on our close-shaved lawns in autumn, looking like little bundles of wax tapers. They belong to *Clavaria vermicularis*, one of the simplest forms of the genus *Clavaria*, which contains a large number of esculent species, amongst which the little candles, though small, are not to be despised when dressed in little faggots, like bundles of asparagus. Other species of the genus are simple and club-shaped, others branched, and some to such a degree that they look like little shrubs divested of their leaves. Some are even, and some much wrinkled; and, though a few are slightly compressed, they never assume the form of foliaceous expansions, though a neighbouring genus, once confounded with it, but distinguished by its more leathery consistence, departs from the cylindrical type. They exhibit the most various hues, as white, golden yellow, rose, amethyst, grey, orange, with many intermediate tints.

The genus, *Sparassis*, the name of which is derived from σπαράττω, "I tear or lacerate," with the fleshy consistence of *Clavaria* and similar esculent characters, has flattened laminæ, which are in every part covered with the fructifying surface, or hymenium. In *Thelephora* and the closely allied genus, *Stereum*, in which the divisions are often much flattened and expanded, there is not only a leathery consistence, but the hymenium is definite, being confined to the lower surface.

In *Sparassis* the lobes are extremely large and numerous, so as to form a rounded and sometimes hemispherical mass, occasionally a foot or more in diameter, with a height of several inches; which, together with a delicate waxy appearance, render the species most striking objects. The habit is somewhat similar to that of *Millepora reticulata*, an analogy which is not without example amongst other Lithophytes; in which, as Fries remarks, we find forms which remind us of such genera as *Agaricus, Boletus, Hydnum, Clavaria, Peziza*, etc. Similar resemblances occur amongst the galls on leaves produced by insects, which accordingly have been confounded by superficial observers, even since the principles of Fungology have been better known, with true fungi.

Sparassis laminosa, which may be considered as the type of the genus, has not yet occurred in this country. It is found on old oak stumps, or amongst oak chips, and acquires the size of a large cauliflower. When pure in colour and young it is excellent, but it soon acquires a yellow tinge and disagreeable smell, and is then wholly unfit for food. The laminæ are very

large and broad, springing from a very short stem, and are narrow and wedge-shaped below, but dilated above, and confluent with each other in every direction.

Sparassis crispa, though sometimes attaining a considerable size, is on a smaller scale. The laminæ are more rounded and leaf-like, though curled, and folded, and variously lobed and laciniate, with a crest-like margin, and springing from a well-marked, thick, rooting stem, the greater part of which is sunk in the soil. The hymenium is more or less uneven, and rather wrinkled, or rough, with little wart-like elevations. In decay the margin becomes soft, acquiring first a yellow, then a brownish tinge, and finally the whole forms a loathsome mass. Like all other esculent fungi, those specimens only are fit for use in which there is not the slightest tendency to decay.

Sparassis crispa, which was found in a fir wood in south-east Berkshire, between the Asylum for Criminals and the Wellington College, where there is much fern and heath, occurs in several parts of Europe. It is rare in Sweden, but more common in Germany, especially about Prag, where it is frequently brought for sale to the market. It also occurs in France in the provinces bordering on the Rhine, where it is said by Roques to be highly valued. We have not heard of its being used in Hungary, nor does it occur in a large collection of fungi gathered in the neighbourhood of Schemnitz.

It is scarcely probable that it will be found in this country in sufficient quantities to make it an article of food, but in case it should be found plentiful, we subjoin Roques' "*indications*" for its preparation, which apply equally to true species of *Clavaria*, to which genus, indeed, it is referred by Roques, in this following Wulfen, who described it in *Jacquin's Miscellanea Austriaca*. Schæffer referred it previously to *Elvella*, with a less correct appreciation of its affinities.

"The plant," says Monsieur Roques, "should be well cleaned from any particles of soil which may adhere to it, then washed in warm water and thoroughly drained, after which it should be baked with butter, parsley, a little eschallot, or a soupçon of garlic, and seasoned with pepper and salt. When tender, cream and yelks of eggs should be added. While baking, a few spoonfuls of stock or broth may be added occasionally, to make it more tender. In Austria it is simply fried in butter, and seasoned with sweet basil.

OBSERVATIONS ON THE THREE-SPINED STICKLEBACK—ITS OVA AND FRY.

GASTEROSTEUS ACULEATUS.—Linnæus and Bloch.
GASTEROSTEUS SPINULOSUS.—Yarrell, Br. F. vol. i.

BY J. H. HORSFALL.

(*With an Illustration.*)

THE taste for aquaria may not be so fashionable as it was some time ago, but the taste for pisciculture is at *fever heat*, and I know of no object more interesting to the microscopist than the ova and fry of fish.

Those who may not be able to procure fecundated ova of salmon or trout, may yet derive as much amusement and instruction by examining the ova of inferior fish, and by studying its development be able to follow the scientific lecturer in his description of the ova and fry of the more valuable kinds.

I am induced to make these remarks from having, on the 3rd of June last, found several nests of the three-spined stickleback in a small brook near Leeds, which, after leaving Adel Dam, runs through the village of Meanwood, at which place it receives the refuse of some large tanneries, in which polluted water the nests appeared to be as abundant as in the purer water nearer the source of the brook.

THREE-SPINED STICKLEBACK, EIGHT DAYS OLD.

NATURAL SIZE.

The nests were about four or five yards apart, and guarding each nest was a male stickleback, and it was easy to see at a glance which fish was the master tyrant of the colony, his colours being much brighter and more vivid than the others in his immediate vicinity could show; the back a rich green, growing darker towards the tail; inside the lower jaw, and along the gill covers and belly, a vivid red; the eye deep blue, with a rich deep black pupil, the fins appearing nearly transparent.

I secured the most brilliant-coloured male fish I could find, and the nest he was guarding; it was full of ova, in which

could be seen plainly the eyes of the embryo fry. On reaching home, however, I found the colour of the fish much duller, and the green on the back had changed to a dusky blue.

In Mr. Couch's *History of the Fishes of the British Islands*, vol. i. p. 167,* is a most interesting account of the habits of this fish, especially its pugnacious disposition. For this reason I placed in the same vessel with the nest and the male fish three females. At once the male began a furious attack on the trio, chasing them about, seizing the most weakly by the tail, dragging it half round the vessel, rising with it to the surface of the water, as if to force it out; sometimes he would seize it by the pectoral fin, and turn it violently on its side, continuing these attacks incessantly, until, in twelve hours, the weakest female died; the next died in about six hours after the first. During these attacks the females acted only on the defensive, by projecting the ventral spines, and could they have received him on the sharp point of one of these weapons, such was the force with which he swam at the female, that death to the tyrant must have immediately followed. The male was very bold; he would follow the feather with which I removed the newly-hatched fry, and if the fry escaped off the feather, he seized his infant fish, and devoured it at once. From the first dead female I abstracted some immature ova, which he pounced upon the moment I placed them in the water; then he blew out a portion, re-caught it as it descended, and again ejected a portion to renew his attack on the second dying female. When resting from his attacks on the other fish, he invariably hovered with his nose close to the hole of the nest, with tail considerably elevated, and blew a strong current of water through the nest by means of his pectoral fins.

The nest is curiously formed, but not of such minute particles as those described in Mr. Couch's account. One piece of withered grass measured seven inches, and was so interwoven with the rest as to drag the whole nest some distance before I could extricate it. To save the life of the surviving female, I put her into a separate vessel, and as soon as the male found himself alone he swam round the nest several times, forming it into shape by the rapid action of his pectoral fins; at short intervals he plunged his nose into the opening as if to clear it, and resumed his position, hovering over the nest, and forcing water in a strong current through it. His dorsal spines were now laid back so as to be hardly visible; when, however, he was attacking the females these spines were constantly erect. He often took the empty crusts of the hatched ova, as well as the

* *A History of the Fishes of the British Islands.* By Jonathan Couch, Esq., F.L.S. London: *Groombridge and Sons.*

fry that had died in the hatching, into his mouth, but instantly ejected them.

The fry began to hatch out the day I got the nest; three ova hatched while under examination with the microscope. First I saw distinctly the entire fish curled up in the shell of the ovum; a convulsive movement, and the tail protruded, and, by a continuance of these convulsions, the entire fish freed itself from the crust of the ovum in about twenty-five minutes after the crust was first ruptured; in some instances the head and tail protruded simultaneously, in which case the crust of the ovum remained round the fry like an awkward belt, which was not got rid of under forty-eight hours.

The newly-hatched fry is a quarter of an inch long, and is furnished with a transparent membrane, like the fry of salmon and trout. This membrane commences where the anterior dorsal fin in the adult fish is seen, and continues unbroken till it reaches a short way over the umbilical vesicle, where it terminates. Inside this membrane, forming the outline of the fish itself, a very fine dark brown line extends all round the fish, and inside this a faint double streak of a pale orange colour. These orange lines are blood-vessels, and, with a high power, the blood-discs can be clearly seen running from and to the heart, which is situated just under the lower jaw, its colour light red, its beat rapid, the mouth of the fish opening with every pulsation of the heart; the eyes as well as the head are large, the latter covered with several irregular dark brown spots. On the day after hatching, the fish assumes much more colour, losing its transparency, so that the flow of blood in the body is not so clearly seen; but in the umbilical vesicle, which is becoming rapidly absorbed, the flow of blood in its numerous vessels is very visible. The incessant motion of the pectoral fins suggests the fluttering of a phantom, they are so transparent.

On the third day after hatching, the fry is much more covered, especially on the head, with dark brown spots, having deeply serrated edges; some of these spots also appear on the umbilical vesicle. Through this colour the heart is no longer visible, nor any blood-vessels, except those between the rays of the pectoral fins, which are losing their transparency, and are at times for a moment stationary. The eyes as well as the head occasionally move, the mouth continually opens and shuts; the outer circle of the eye can be perceived through the microscope. The fry now are very active, often swimming to the surface of the water, then sinking gradually to the bottom, when, after a short rest, they dart rapidly about again.

On the fourth, fifth, and sixth day after hatching, my infant sticklebacks make little progress; the umbilical vesicle is gra-

dually being absorbed, the spots on the body show less serrated edges, and are deeper in colour; the entire surface of the fish is stained rather than coloured a cinnamon brown; the enveloping membrane is much reduced in places, especially at what will form the root of the caudal fin.

On the seventh day the rays of the anal fin begin to appear, six imperfect rays of a brown colour being visible under the microscope; the lower jaw alone maintains its transparency. On the eighth day, the markings of the anal fin are more perfect, the membrane is much narrower, except where the spines and fins in the adult fish are seen; four days after this, or on the twelfth day, the first formation of the caudal fin is seen, also the protrusion of the ventral spines.

Notwithstanding a daily change of water, on the thirteenth day my infant sticklebacks were attacked by a parasite, invisible to the naked eye, but, when magnified, it was adhering to the membrane which still encircled the fish. This membrane showed clearly the ravages of the invader, being torn in several places, and by this I lost my whole stock, losing first their activity and in twelve hours, life.

It was my intention to have ascertained how long after fecundation the ova remain before the fry are hatched, and the different periods that elapse in the development of the dorsal and ventral spines, and also the dorsal, caudal, and anal fins; this I am obliged to defer to another season. I have, however, seen enough to prove that the delightful study of pisciculture may be successfully followed without practising on the ova of valuable fish like the salmon and trout, for quite sufficient resemblance exists between the development of the ova and fry of the insignificant sticklebacks and the king of fresh-water fishes, that he who studies the inferior may easily understand the greater.

XUM

THE MOSSES ANACALYPTA AND POTTIA.

BY M. G. CAMPBELL.

FEBRUARY, with its chilling breezes, its sleety storms, its leafless trees, and its oft snowy lawns, while it seems to freeze the young buds of the tall trees, and hang their boughs with icicles, yet spares the lowly mosses, and gives some of the most minute and delicate strength to ripen their tiny fruits.

Of these, the genus Anacalypta stands foremost, deriving its name from *ἄνα, above,* and *καλυπτὸς, covered,* in allusion to the circumstance that the calyptra remains on the capsule until the spores are perfectly ripe, which is, doubtless, a provision of nature against the inclemency of the season.

The members of this, like those of its sub-genus *Pottia,* named in honour of Professor Pott, of Brunswick, are small, chiefly annual or biennial mosses, loosely gregarious, growing upon newly-exposed soil, and occasionally upon walls in low-land districts. The two sections are exceedingly similar in mode of growth, in fruit, in the form and structure of the leaves, and in the inflorescence; but differ in the Pottias being without a peristome, while the Anacalyptas proper are furnished with a peristome, which consists of a single row of sixteen teeth, united at the base by a narrow membrane, plane, lanceolate or imperfectly divided into two portions, or perforated; occasionally, however, incomplete or fragmentary, and without a medial line. The spores, too, are rather smaller than in Pottia.

On banks and in fields in the middle and south of Britain, those who wish to investigate this interesting group may find the beautiful little *Anacalypta Starkeana, (Stark's Anacalypta),* of which we give a magnified illustration; the natural size of the plant being less than one line in height of stem, and, when in fruit, with a seta of about equal length; but in this, as in other respects, the species is variable, for in the same tuft may be found specimens with fruit-stalks twice as long as others. It will, however, admirably serve as a type of both sections of this genus; indeed, it has puzzled muscologists to determine to which section it should properly be given, the presence or absence of a peristome being the chief difference between it and *Pottia minutula,* or the *dwarf Pottia,* variety *conica,* which might almost be called a toothless *Anacalypta Starkeana;* and, if we may judge by the variety of names that have been conferred upon it, as A. Starkeana by Nees and Hornshuch, Bruch and Schimper;

ANACALYPTA STARKEANA.

Pottia Starkeana, by C. Müller; Grimmia Starkeana, by Smith and others; Bryum minutum, by Dickson; and Weissia affinis by Hooker and Taylor; while Wilson confesses that he "dare not pronounce them" (the two mosses, *Anacalypta Starkeana* and *Pottia minutula*) "distinct, having examined numberless intermediate forms, which pass insensibly from the one to the other." We shall, perhaps, be ready to exclaim, "Who shall decide where doctors disagree?"* Yet we conceive that, if gathered during the present month, before there is a chance of the peristome being lost, which may be more fugatious than hitherto suspected; and if due attention be paid to the position of the foliage, that of *P. minutula* being more erect and appressed to the stem in a dry state, in all the specimens we have examined, as well as having the lower leaves frequently of a reddish hue, there may be less difficulty in deciding on its proper name and location.

Having thus shown that the peculiar form of the fruit and foliage is sufficiently characteristic of the whole family, genus, and sub-genus, we now proceed to describe *Anacalypta Starkeana* more particularly.

As we have already said, its length of stem is less than one twelfth of an inch, within which stature it bears two kinds of leaves, the lower ones less, of an ovate acuminate form; the upper ones larger, oblong acuminate, or lanceolate, carinato-concave, the margin recurved, the reddish nerve excurrent, and forming a short mucro at the apex of the leaf, very seldom discontinued below it, all of them spreading; the areolæ small and roundish, like the perforations of a very fine pin or needle point, larger at the base, the capsule oval, with rather thin walls of a shining chestnut-brown, sometimes regularly striped with lines of a deeper tint; the lid conical and obtuse; annulus persistent; teeth of the peristome usually of a pale red or yellow colour, lanceolate, and obtuse, with distant transverse bars, but very variable, both in form and colour, more or less perforated, without a medial line, and erect when dry; the fruit-stalk loosely cellular, almost semi-pellucid, usually straight when growing, slightly curved in a dry state, and somewhat twisted; the spores smoothish, the barren flowers axilliary, mostly leafless, sometimes, but rarely, with a single involveral leaf; while the *Pottia minutula*, which in other respects it so nearly resembles, has barren flowers of from two to three leaved. Both are found in fruit during January and February, but the Pottia appears to continue in fructification longer than the Anacalypta.

* It must, however, be acknowledged that there are few mosses which have not been honoured with a like multiplicity of names, a circumstance, doubtless, chiefly arising from the advance of science rendering the old nomenclature defective, from incorrectness or inadequacy.

XUM

There are three other Anacalyptas, all of which fruit in the spring. Of these, *A. cæspitosa*, or the *Round-fruited*, grows on chalk hills, and has been found on Woolsonbury Hill, near Hurstpierpoint, Sussex. It is about the same size as *A. Starkeana*, but is easily distinguished from it by the rostrate lid of the capsule, which latter is also more ovate, and of a yellowish-brown, with a yellowish fruit-stalk, and plane-margined and narrower foliage. *A. cæspitosa* has also a distinct perichætium, the inner perichætial leaf being very broad and sheathing, and a yellowish annulus surrounds the mouth of the capsule. It fruits in March, as does also *Anacalypta lanceolata*, or the *Lance-leaved Anacalypta*. The latter is, however, of taller stature, the stems being from one line to half an inch long. The oval capsule, tapering at the base into a rather long reddish pedicel, has rather thick walls, of a glossy chestnut colour, and is somewhat contracted below the mouth when dry. The lid is obliquely rostrate, but varies in length, sometimes longer, sometimes shorter; the simple annulus dehiscing in fragments; and the peristome in this, as in Starkeana, is extremely variable; sometimes the teeth are almost linear, and rather long; sometimes shorter, and lanceolate obtuse; sometimes linear lanceolate, and rather acute, formed of a double row of cellules, here and there perforated along the medial line; somewhat jointed, flattish and minutely papillose, *i. e.*, rough, with small roundish prominences, and usually of a pale reddish-fawn colour; sometimes of a deeper red; sub-erect when dry, or slightly incurved at the apex; somewhat oblique in direction, and always connected below by a common membrane. The yellowish-brown calyptra reaches half-way down the capsule.

The rare *Anacalypta latifolia* also fruits in the spring, but it can never be confounded with either of the others; its singularly bulb-like clustered foliage, of an almost silvery hue, gives it so peculiar an aspect as at once to distinguish it. The leaves are roundish-ovate, apiculate, or obtuse, very concave and imbricated, not recurved in the margin, membranous, shining, and whitish, with an erect capsule, whose lid is half as long as itself, and bearing a calyptra that reaches half-way down the capsule; the seta long, and annulus sub-persistent. It is an elegant moss, inhabiting alpine districts, where it is found in the crevices of rocks. It is met with in several places in Switzerland, and has been found on the Clova mountains in Scotland, in Glen Phee or Glen Dole, by Mr. Drummond.

Of the Pottias, *P. cavifolia*, or the *oval-leaved Pottia*, is remarkable for the variation in the length of its leaves, fruit-stalk, and capsule, even when growing in the same locality; the different forms growing in patches, not promiscuously, but

in separate groups; some having fruit-stalks more than half an inch long, others with the seta scarcely a line in height, and with leaves equally diverse, so that one unacquainted with the circumstance might easily imagine them to belong to different species. It may, however, always be known by the peculiarity of three or four membranous appendages attached to the nerve on the upper side of the leaf. These appendages are analogous to the lamellæ of *Polytrichum hercynicum* and the allied species.

The leaves are, besides, erecto-patent, concave, slightly imbricated, obovate, or elliptical, and more or less piliferous; sometimes, however, they are destitute of the hairy point. The capsule is oval, crowning a shorter or longer pedicel, and having an obliquely rostrate lid shorter than the capsule. It is found on banks and mud-walls, and bears its fruit in March.

Pottia truncata, or the *common Pottia*, ripens its fruit in February and March. This also varies in stature, having stems from half a line to half an inch long; sometimes simple, sometimes branched, with a fruit-stalk two or three lines in length; and, though it chiefly bears solitary capsules, sometimes two and even three are found growing together. These capsules are sometimes very short, broad, and wide-mouthed, at others oblong and truncate. The leaves are more or less spreading, widely lanceolate, often wider above the middle, oblong and acuminate, with a reflexed margin, the nerve most frequently sub-excurrent, but occasionally ceasing below the apex.

Wilson remarks that a variety of this moss sometimes occurs in wet seasons, "with the stem branched in a fasciculated manner, with six or eight branches, each bearing a capsule."

The lid is obliquely rostrate, and convex at the base.

Another member of the family fruiting in February is *Pottia Wilsoni*, the *oval-fruited Pottia*. It grows on banks in a sandy soil, intermixed with the larger variety of *P. truncata;* was found by Mr. Wilson on rocky ground near Bangor and Carnarvon; also near Llanfaelog and Holyhead in North Wales; by others in Sussex, near Wrexham, and near Over in Cheshire. It is supposed not to be unfrequent, but liable to be mistaken for *P. cavifolia* or for *P. truncata*. In aspect, however, it differs considerably from the latter, growing in close, round, convex tufts, of a pale, glaucous colour; whereas *P. truncata*, though occurring in similar situations, presents extended flat patches with dark green foliage; and, while the leaves of *P. truncata* are quinquefarious, those of *P. Wilsoni* are octofarious. The nerve, too, is more excurrent, forming a mucro equal to half the width of the leaf. The areolation of the leaf is opaque and small in the upper part, larger and dia-

XUM

phanous towards the base. It also differs in the inflorescence, *P. truncata* bearing gemmiform, barren flowers, while *P. Wilsoni* has naked antheridia, and fruits nearly a month earlier. They need not, therefore, be confounded; and the peculiar structure of the leaves of *P. cavifolia* easily distinguishes it when placed under the microscope.

Pottia crinita, or *bristly Pottia*, is another which bears fruit in February, with stems more densely and compactly tufted than *P. Wilsoni*, and very obtuse, octofarious leaves, in this respect not unlike *P. Wilsoni*, but with a stronger rigid nerve, running out into a much longer bristle point, twice or thrice as long as in *P. Wilsoni*, scarcely opaque; the areolæ larger, capsule elliptic-oblong, scarcely contracted at the mouth, having an oblique rostellate lid, a smooth calyptra, and naked antheridia.

Pottia Heimii, the *lance-leaved Pottia*, inhabits moist banks near the sea, and is rarely in fruit till April or May. This is a taller species, but, like its congeners, it varies considerably, differing in the size, shape, and direction of the leaves, as well as in the length of the capsule and lid, while the fruit-stalk is sometimes less than half an inch, at other times an inch long.

The stems are more or less branched, the leaves concave, lanceolate, denticulate, or serrated at the apex, which is acute; margin plane, not recurved; the nerve reddish, scarcely at all excurrent, and the inflorescence polygamous, having the barren and fertile flowers variously disposed on the same individual; the flowers frequently synoicous, sometimes entirely barren; in which case it is destitute of paraphyses. When both organs are found united in the same flower, they are accompanied by subclavate paraphyses, longer than the antheridia. The capsule is of a reddish brown, erect, obovate, or oblong and truncate, not at all contracted at the mouth; the lid obliquely rostrate, and adhering to the columella.

We have thus completed the review of this minute, variable, but interesting genus, as far, at least, as British examples extend.

"A Windfall for the Microscope."

A WINDFALL FOR THE MICROSCOPE.

BY THE HON. MRS. WARD.

(*With a Coloured Plate.*)

ANY one who (whether truly or otherwise) has acquired the name of a naturalist is liable to be asked concerning a jelly-like substance occasionally appearing in sufficient quantity to attract observation. The question sometimes will be, "What is that jelly which falls from the sky?" as though that method of deposition could alone account for its sudden appearance.

In answer, we have generally to say on being shown a specimen, that the jelly alluded to has certainly not fallen from the sky, and can pronounce it to be the plant described by Linnæus as *Tremella nostoc*, and variously named by other authorities *Nostoc*, *Tremella*, "witch-butter," and "shot stars." This Nostoc is of a brownish-green colour, and, with a high magnifying power, proves to be composed of a multitude of very beautiful beaded filaments, lying in gelatinous fronds. These filaments, it would seem, rapidly subdivide, and in this way increase, while new fronds form around them when favoured by damp. "They frequently," says Dr. Carpenter,* "attain a very considerable size, and as they occasionally present themselves quite suddenly (especially in the latter part of the autumn on damp garden walks), they have received the name of 'fallen stars.' They are not always so suddenly produced, however, as they appear to be; for they shrink up into mere films in dry weather, and expand again with the first shower."

The inquirers will, perhaps, be content with this explanation; but possibly the objection may be raised that Nostoc is not the only kind of jelly, and they have seen some of quite different appearance. Possibly, then, a story which I have to tell of some jelly found under circumstances of undoubted isolation, and in a place where nothing of the sort had existed a few hours before, may throw light on the matter. It happened a few years ago, and I took such notes as I judged of importance at the time, making careful drawings of the mysterious substance, and the unexpected changes which it underwent.

To proceed, then: On the 20th of August I received from a friend fourteen miles off a little bottle containing a pale, jelly-like substance (Fig. 1), and a paper containing about thirty black grains, at first sight much resembling dry tea (Fig. 2). The information my friend sent with them was that they had been found on the deck of his yacht, the vessel being

* *The Microscope and its Revelations*, p. 338.

XUM

moored as usual at some distance from land in an inlet of Lough Ree, county Westmeath.

I placed the jelly carefully in a tumbler of rain-water, and perceived that it was composed of small, roundish masses of two kinds, one containing minute brown particles (Fig. 3), and the other green (Fig. 4), and both bearing a general resemblance to miniature frog-spawn. The masses containing green particles were each attached to a cord-like fibre, and were more compact than those with brown. The resemblance to frog-spawn recalled to my mind a dried specimen which I had lately seen of the plant *Batrachospermum*, and had the effect of leading me to refer them at that time to the vegetable kingdom.

The microscope did not throw much light on the matter. With a magnifying power of fifteen diameters, it showed the brown spots as in Fig. 5, and the green as in Fig. 6; but it helped me to make out something about the black, tea-like grains (Fig. 2). These proved capable of being softened; a grain, placed for a few minutes in water, separated into oval particles, very similar to the brown particles of the jelly, but flatter, as if from drying and mutual pressure. (Figs. 7, 8.) The idea at once suggested itself that it had been exactly similar to the jelly; but, from being exposed to the sun, had dried and hardened.

I wrote to ask a few questions about the finding of the jelly and black grains, and ascertained the following particulars:—

The boatman whose duty it was to scour the deck each morning was repeatedly annoyed by finding spots of jelly (which he compared to "small star-fish") lying on the deck, sail-cover, etc. He at first thought he had taken it up when wetting the deck with water from the lake; but, when the weather became so rainy as to make this artificial wetting unnecessary, he still found them.

On two mornings, instead of jelly, the black grains were found. My correspondent went on board his yacht on one of these occasions. The morning was fine, and the grains felt hard like glue, and came away easily from the wood when a penknife was passed beneath them. When they lay on a flat surface they were rounded like drops of sealing-wax; on sloping surfaces they were elongated; for instance, those lying on the middle of the cylindrical "sail-coat" which covers the mainsail when furled, were round, while those at its sides appeared to have run down, as dropped glue would have done. My informant did not observe any grains on ropes in a vertical position, or on the mast; but he noticed a coil of perfectly white rope spotted all over with them. The boatman said he thought the black grains appeared in rather greater quantity

than the jelly had done; he also remarked that they were most abundant near the stern of the vessel, just where snow with a little wind, or small hail with a good deal of wind would have been sure to collect; but this remark refers only to their *position*; the total *quantity* was much smaller than a deposit of snow or hail would have been.

Having now fully detailed the antecedents of the jelly, I proceed to the second part of my story. I left the jelly for five days in the tumbler—out of sight, and, I believe, to a certain extent, out of mind also; and the small portion of that with brown particles which I had last examined with the microscope remained still in the "animalcule cage," slightly flattened between its two discs of glass.

On placing the animalcule cage under the microscope on August 25th I saw with sudden surprise that several singular-looking *larvæ* had made their appearance among the jelly. That they had been produced from the brown particles was evident, as many empty shells were visible, and other similar larvæ could be discerned ready to come out of the particles, or *eggs*, as they may in future be called.

Fig. 9 shows the larvæ, the eggs, and the "empty shells" above alluded to. The eggs display the cellular structure so commonly observed in minute aquatic insects and animalcules.

These larvæ were remarkable for their transparency, reminding the spectator of Dickens's observation with reference to *Marley's ghost*, — "His body was transparent, so that Scrooge, observing him and looking through his waistcoat could see the two buttons on his coat behind!" I at once recognized their forms as familiar to me. A similar insect, with its strange, seal-like head and tiny pairs of feet (seal-like also) has often thrust itself across the field of view—a giant among pigmies—while I have been examining minute animalcules with one of the higher powers of the microscope.

The larvæ appeared perpetually struggling to free themselves from the jelly, and always incommoded by the slippery glass above and below them; except when they indulged in a lively dance in the surrounding drop of water. Their gait in this movement having reminded me of the common "blood-worm," Fig. 11 (larva of *Chironomus plumosus*, an insect nearly allied to the gnats), I obtained one of the latter from a water-trough which abounded in its mud hiding-places, and observed that the new larvæ were very similar to it.

This gave me a hint for the more comfortable establishment of the little Westmeath strangers. I placed them in a wine-glass half full of stagnant water, strained through muslin to guard against the presence of larger, and possibly hostile insects; and to the same miniature aquarium I removed the

XUM

"brown particles" from the tumbler, observing that a similar change had taken place among them. In less than half an hour numbers of the little larvæ had rolled themselves in mud cases (Fig. 10).

Meanwhile the green particles remained unaltered. On the 31st, however, their contents as seen through the microscope seemed to assume a more defined shape. As may be supposed, they were inspected daily with much curiosity. On the 2nd of September the uniform green spots, so often watched, were evidently seen to be exchanged for *something moving*. It was one of the excitements of a microscope to guess what appearance they would have when magnified.

Fig. 12 represents what the microscope showed when they were conveyed to it, and the form at first sight reminds one of a crayfish, or lobster; but they proved to be the "caddis-worm," larva of the caddis-fly. The immensely long, jointed legs, alike suited for building the well-known habitations of the caddis-worm, and for walking nimbly among water-weeds, and the soft body, evidently requiring defensive armour, were soon recognized.

I placed them in a glass, stocked with what I believed to be the materials of their trade; and at first they floated somewhat helplessly on the surface of the water. Ere long, however, these young creatures began very properly to make their clothes; or, as one may say, to build their houses, for these were real *buildings*, although no larger than those represented at Fig. 14. The reader may imagine how small the grains of sand must be of which they are constructed. At Fig. 13 these tiny edifices may be seen magnified fifteen diameters.

The jelly, then, was no other than the eggs of insects, and its appearance corresponded with some descriptions given by Westwood.* He speaks of the eggs of one of the Chironomus family as deposited on the leaves of aquatic plants, and covered with a mass of gluten; and he says of the caddis-flies (*Phryganeidæ*) that they deposit their eggs in a double gelatinous mass, which is of a green colour, and he adds that the female of *Phryganea grandis* has been observed to creep down the stems of aquatic plants under the water, for the purpose of placing her eggs in a desirable position.

The young caddis-worms which emerged on September 2nd were alive and well a fortnight later, and had enlarged their cases considerably. Unfortunately the story ends here. I was called away from home, locked up the wine-glasses which contained the two kinds of larvæ,—found them dried up on my return, and was unsuccessful in my attempts for their resuscitation. But I think it will be pronounced that I had

* *Introduction to the Modern Classification of Insects*, vol. ii., pp. 62, 516.

the advantage of having watched a curious part of their history.

And now, after all, how did the jelly get upon the deck of the "Dulcinea"? No doubt *Chironomus* and *Phryganea* deposited their eggs there; but why so recklessly over sail-coat, coil of rope, and deck, instead of in the lake close at hand? *That* I do not attempt to explain, but merely state the facts as I observed or heard them.

MINSTRELS OF THE WINTER.

BY SHIRLEY HIBBERD.

THERE are not many, even among genuine inquirers and observers, who can exercise the needful patience to gather knowledge for themselves on the subject of winter birds. A man who has spent six days in stalking a "muckle hart of Benmore," or who has passed a night in a hunter's lodge on the shore of a lonely mere in Le Morvan, or has endured wind, rain, and hunger in angling for grayling beside a poor swim on the banks of the Wye, the Dove, or the Ribble, may be able to sit still for hours on a muggy December day, or during the prevalence of a north-easter in January, and make notes of what birds move about among the dead leaves and fern in the copse, or try their luck beside the frozen brook, or sail high in the heavens, screaming more discordantly than the wind, on their way to discover a land of plenty, when frost has made a more terrible dearth than a burning drought in summer time. It is not at all a barren occupation to sit at a window overlooking an open country or a well wooded garden, and by the aid of a short-focus telescope, take note of all the birds that come and go, how many robins, blackbirds, thrushes, how many less-known aves flit across the scene, or pause for a season and explore for sustenance, and perhaps whistle a merry song, or engage in a small encounter—though birds rarely fight in winter—and thus acquire somewhat of a notion of the ornithological wealth of the district. One thing I know by experience, that if the residents in the suburbs of London, especially those dwelling three or more miles from St. Paul's, were to engage themselves in this very quiet and inexciting recreation occasionally, they would derive considerable satisfaction in learning by observation, that many more birds visit the gardens in the suburbs of London, as, indeed, of all large towns, than is usually supposed; and this knowledge might make many more contented with their lot who are now

XUM

bitter with dissatisfaction at the rapid growth of towns and the change which is passing over all things rural. I am often amused at the look of astonishment with which friends sometimes receive my verbal accounts of birds that visit my garden, but I am not surprised that they find it hard to believe, and disposed to receive the narrative as a joke, for I sometimes hear one say, "I haven't seen a robin the whole winter through," though the speaker lives, perhaps, in an open rural spot, where a bird-catcher could make a good living, if allowed to put down traps in the garden for robins only. The fact is, the majority of people go through the world with their eyes shut. Intellectual observers are thinly scattered, and it is as yet known but to few how abundant and how cheap are the sources of human happiness.

Not that an observer now pressing his nose to the window pane, or chattering his teeth on a bleak common, would see or hear a great many birds. The great flocks of harvest finches that winged their way across the stubbles like driving showers, appearing and re-appearing as they were disturbed by the sound of wheels, or voices, or guns, have all dispersed; the plough has broken up their pastures, and they, for the most part, forage for themselves singly, or in very small parties, the males and females being for the present separated. In the gardens there are fewer birds of all kinds, even blackbirds, thrushes, and sparrows are scarce, and, what is worse, they are *quiet*. From the end of October to the end of January, the country is as quiet as it is leafless, indeed, more quiet than leafless, and the silence is oftentimes oppressive, especially when far into November and December the meadows are still as green as in April, many trees still holding their leaves, and the sky bright and blue, with soft breezes blowing, and everything, except the birds, affecting to consider winter an impossibility. But there is no hypocrisy among the birdies, *their* winter has come, and they wait without murmuring the return of spring; and because of this silence I think it well to gossip a little on the song birds of winter; for happily there are a few, and Nature has ordered it that no day or hour in the whole year round should pass without some sort of voice to serve it for a chronicle.

"What are the birds now to be heard? Tell us," you say, "about the minstrels of the winter, their names, their features, and their songs." On just such a day as I write this, December 18th—barometer 30·41, thermometer in the shade, 42°—the sun shining brightly in a cloudless grey sky, breeze from the north-east, brisk enough to keep all the windmills clacking—on just such a day I was sauntering beside the Avon at Ringwood, in the New Forest, wondering how the cows could

manage to get so fat on potamageton and other water plants that they always feed upon there, when suddenly I was startled by a splash, and saw a little bird dash into the clear stream beside me, and fly along the green weedy bed with the swiftness of an arrow, then emerge, fly upwards, and alight on the bough of a willow overhanging the water. There for a moment he was busy jerking down his throat some sort of food he had captured during his brief submergence, and then he broke out into such a clear ringing song, that I might have fancied the whole affair a dream, or the bird an angel in disguise. I remember the event the more particularly, because, till then, I always believed the water blackbird (*Cinclus aquaticus*) to be exclusively a native of the highland glens, where it overpowers the roar of the waterfall and the muttering of the mountain breeze with its rich, wild melody, loudest among the feathered minstrels of Britain. I soon lost my friend; he vanished as suddenly as he appeared, and but once since have I seen this most curious, most rare, and most musical of all the minstrels of the winter.

Bechstein describes the water-ousel as a favourite cage-bird with the Germans, and Macgillivray, greatest of word painters, tells of its habits as observed by him among the fastnesses of the north. In form and features this bird resembles a starling more than a blackbird; the head tapers towards the beak, the beak is long, flattish, and black, the head and neck are of a rusty brown, the rest of the upper part of the body is black, with an ashy tint, the quill feathers and the very short tail are black, breast pure white, shading into deep maroon, and that again shading into black, which extends over the belly. It is a peculiar bird; when looking forward in a half crouching attitude, and for a moment motionless, it has the look of a hungry charity boy with a bob-tail coat; but when it lifts up its head and stands almost erect, showing its broad white breast, to pour out its rich mellifluous song, there is a pride and daring in its attitude befitting a bird that loves best the mountain breeze, the brawling brook, and the foaming waterfall. It haunts the stream in the capacity of a fisher, and its food is principally the spawn of trout and salmon, and this it seems to take during its flight under water, and without needing to pause where it is impossible it could continue for more than a few seconds at a time.

Another real minstrel of the winter is the missel-thrush, which I mention with less of the pleasure I should otherwise experience, because I have found it impossible to cultivate mistletoe in my garden at Stoke Newington through the vast increase of London smoke, consequent on the growth of buildings on every hand. The China rose was the first to feel the

XUM

shock, now the mistletoe, which used to thrive in these parts, begins to show signs of sickliness, and when we lose that we must say farewell to the missel-thrush, or rather he will take farewell of us, and we shall miss his boisterous song. Hitherto the missel-thrush (*Turdus viscivorus*) has been a constant and a frequent visitor at Stoke Newington, and all the gardens of the northern suburbs. He is indeed fond of the suburbs of London, and often seen at Brixton, Tulse Hill, Sydenham, and other spots which still retain a show of rurality. But though fond of mistletoe berries, there is no necessary connection between the bird and the druidical plant; and if we lose the missel-thrush it will not be because the mistletoe has perished, but because the new houses interpose a barrier between us and the open country. Every winter during the past seven years I have not failed to see the missel-thrush in the garden half-a-dozen times at least, and it is some satisfaction to know that a great boss of fruiting ivy, which bears berries most abundantly, is an attraction to this and other winter songsters, and no increase of building will destroy that or render it less fruitful. Very few birds are gregarious in winter, two or three blackbirds and song-thrushes may sometimes be seen on the lawn at one time, and occasionally a dozen sparrows will forage in company among the rhododendrons; but the storm-cock is loneliest of the lonely—an emblem of solitude—for he comes alone, he comes at times when most other birds are cowering for shelter in unseen retreats, and for a thrush of any kind his size is so vast and his aspect so daring, that there is a charm about his solitariness, and his loud, melancholy, monotonous song is as appropriate to his whole character and habits as to the dreary season when he most rejoices to utter it. It appears not to have been noticed that this bird plays the hawk occasionally among the minor minstrels, and is at times as much feared by small birds as the buzzard and the kite. I have seen a missel-thrush make a dash into a bed of American shrubs in front of my drawing-room windows, and put to flight a score or more of sparrows with expressions of alarm, as if a bomb-shell had fallen amongst them. White remarks upon its pugnacity during the season of nidification, "driving such birds as approach its nest with great fury to a distance. The Welsh call it *pen y llwyn*, the head or master of the coppice. He suffers no magpie, jay, or blackbird to enter the garden where he haunts, and is for the time a good guard to the new-sown legumens." This last note has strangely escaped the notice of the advocates of birds against the destroyers who make no exception in their wholesale devastation, by trap, poison, and gun. But it is not in the breeding season only that the storm-cock is pugnacious; he is at all times a hater of birds, even of

his own race, and, like the robin, leads a lonely life, knowing no fellowship except with his mate while love rules him, and to her showing an attachment as ardent as his hostility to all else is unscrupulous and savage. But he is a "noble savage," and when fairly in song, which does not happen till the new year turns, rejoices to peal out his loud, wild, and mournful notes when every other bird is silenced by the keenness of the wintry blast.

Occasionally in the vicinity of villages, and in well-wooded gardens, the winter days are enlivened by the notes of the woodlark, the wren, the gold-crowned wren, the robin, and small companies of wandering finches. But the extent to which these become musical, indeed the degree in which they visit the abodes of men, depends much upon the weather, and there are times when during frost, fog, and snow, no birds capable of a musical note save the sparrow and the robin are ever seen. Where they hide at such inclement seasons no man can tell, but that many of them perish in hard winters is but too well known by the finding of their dead bodies sometimes in dozens and scores, sometimes in hundreds, in sheltered nooks to which they had resorted for mutual protection, and to perish of want in a community of misery. Even when no such terrors threaten them, the dull weather so common to December makes them all mute, and it is only on those halcyon days when the sun breaks through the gloom, and makes a momentary spring-time, that we are reminded by their music that the world is still peopled with happy feathered creatures. Song birds are not such victims of blind unmeaning impulse, not such mere creatures of instinct as to sing, as Tennyson says, "because they must." They participate with us in the depression consequent on gloom, and the cheerfulness that accompanies life and light; and it is because during December the world is more dead in the aspects of the sky and the state of vegetation than at all other seasons, that then nature is most silent, in a certain sense the grave has closed over all things lovely, and the birdies are buried with the flowers. It is not lack of food, but lack of sunshine that causes the general silence of December; fog is more depressing than frost, and the minstrels that are still capable of song take their moods from the state of the elements, and are simply silent when it would be out of taste to sing. It is worthy of notice in this connection that we celebrate the most joyous festival of the whole year at a time when the aspect of heaven and earth are most depressing, the origin of Christmas lying far back and beyond the blessed history of which it is now the brightest outward symbol, and in some sense but a continuation in an altered form of those Pagan feasts in which the holly, mistletoe, and ivy were originally consecrated as emblems

XUM

of rejoicing. Still with all the dulness of the time, some songs prevail, and when the resident birds have played their parts in the meagre wintry chorus, there are many sojourners that have a song to sing, and a few words will suffice to enumerate all but a few that make themselves conspicuous by their bravery and gaiety.

Let us not forget how courageously the smallest of British birds defies the winter, and is always in a merry mood. The common wren (*Motacilla troglodytes*, Linn.) is as common in the gardens at Stoke Newington as the robin and the thrush. On a sharp winter it is a common occurrence to see half a dozen at a time scuttling along the top fringe of the ivy fence, or bustling about among the dead leaves under the evergreen shrubs, looking like mice, and uttering a very mouse-like squeak, which, like a stray primrose or lingering chrysanthemum, is the more welcome, because there is then little competition, and we are glad of any noise out of doors that is not positively discordant. Neville Wood does real justice to this miniature of a songster. He says, "the song is short, shrill, and remarkably loud in proportion to the size of the bird. It may perhaps be ranked amongst the most trivial of our feathered choristers, but the notes are more prized than they would otherwise be on account of their being frequently heard in mid-winter, when a mere scream would almost seem sweet, especially if it proceeded from the throat of so tiny a bird as the ivy wren. And thus insignificant and humble (with regard to musical merit) as are its strains, I always listen to them with delight in the dreary seasons, though we are apt to overlook them altogether in fairer times." The gold-crowned wren (*Regulus aurocapillus*) I have seen but once here, and that was in the winter of 1858, during a dark drizzly day, when the bird appeared suddenly toying among the branches of a thorn near the window, as if wholly unconscious of the cold, though it is known to be the most susceptible to cold of all the British birds, and looking for the moment as if a stuffed humming bird had suddenly come to life and escaped from a glass shade. After sporting among the shrubs for several minutes, this "winged gem," remarkable for its minuteness, pertness, and the brilliant colour of its crest, made its way in a sort of jerking flight across the garden, shone for a few seconds like a flame on the ivy, and then with a small sound like the creaking of a wheel at a distance made its way towards the distant meadows. I have rarely travelled far in winter in any part of Herts or Surrey without seeing one or more specimens of this pretty bird in the course of a journey; but I never heard it really sing until after the turn of the year, and then to understand the scope and character of its song the listener

should be motionless, or the bird will be mute. In plantations and copses it may generally be met with, and it will always repay the rambler to take a seat on a stone or the stump of a tree, for a chance of a visit and a performance, for the gold wren is inquisitive, and will approach near to the stranger, and sing its small soft, sweet song within a few paces of the listener so long as he maintains comparative stolidity.

Among the winter visitants the fieldfare must take the lead for the excellence of its notes, and perhaps the greenfinch should have the next place, not for sweetness, but garrulousness. The fieldfare-thrush (*Turdus pilaris*) is a handsome bird, with a lively expression and a beautifully dappled breast. It comes with the redwing in October, and leaves us for its Scandinavian breeding grounds some time in April, though both it and the redwing occasionally continue later. The fieldfares go from field to field in vast flocks, preferring open flat countries, and not often separating to visit gardens, though I have seen solitary individuals of both species shot in gardens near London. Ordinarily when these flocks pass, the only notes heard are the call notes, and these are sufficiently unmelodious to deter one from criticism. Opinions differ as to the value of its song. Mr. Wood speaks of having kept one in a cage, but he never heard it sing, "if you had seen it you would have supposed it had some deep project in its head, so wise and solemn did it look." Mr. Blyth says, "its song is a mere chatter." Bechstein says, "its song is a mere harsh and disagreeable warble." Mr. Broderip says, "the song is soft and melodious, and the bird sings agreeably in confinement, to which it soon becomes reconciled." I once had an opportunity of putting these various statements to the test of experiment, and the result was this, that individuals differ considerably in their powers of song; but what is of more importance is this, that there are few bird-fanciers who can distinguish males from the females, and so hen birds are sometimes caged, and hence an unfair verdict upon the musical capabilities of the species. As to caging it, it is the easiest thing in the world, and take care not to give it more food than needful, or it will grow fat and die of heart disease. There are other points of interest in the history of this bird: it has never been known to breed in this country, and in its own Norwegian forests it builds in forks of the fir, and large numbers associate together. Sir Walter Scott makes a strange exception to his usual accuracy of description, where, in the "Lady of the Lake," he describes it as breeding in Britain, and making its nest on the ground—

> "Beneath the broad and ample bone,
> That buckled heart to fear unknown;
> A feeble and a timorous guest,
> The fieldfare framed her lonely nest."

Among the rarer birds that visit us in winter, and by cheerful notes break the sullen monotony of the dreary season, the silktail, the grosbeak, the snowflake, crossbill, mountain finch, and mountain linnet, may occasionally be seen and heard by observers well situated, and the counties of Surrey and Hants are more often favoured, perhaps, by these rare visitants than any other parts of England. I used, when a boy, to catch in the meadows of my native village of Stepney, meally redpoles and greenfinches in numbers greater than I care now to remember, especially as the remembrance includes not only the catching, but the unhappy fate of those birds; for we used sometimes to harness them with twine and have them at school with us all day, sometimes hidden in our sleeves, when the dominie's eyes were to be deceived, and at other times thrust down a boy's neck when there was opportunity for a trick, or a piece of vengeance. Traps and cages were made of impossible materials, a dozen or more unhappy prisoners were pent up in cages not large enough for one to move about freely in, and left to fight, or starve, or perish as they might. We are sometimes beguiled into a wish that we could be "boys once more," but there is no man with a spark of true humanity who would purchase back the joys of boyhood if it were inevitable that we must also be as cruel as a boy; and, alas, it must be said that as a rule, boys *are* cruel, implacably cruel, and inventively wanton in inflicting cruelty on animals, and from the act deriving a pleasure so intense, as to prevent reflection and stifle the voice of conscience, which has some force, even in infants. The redpole (*Linaria pusilla*, Blyth) is both resident and migratory; in the midland it is common throughout the year, frequenting groves and streams; in other places it appears only as a winter visitant, and it is in this character only I have made its acquaintance. The flocks we used to thin made their appearance in December and January, on the site now occupied by the Metropolitan Cemetery and the town which joins it on one side, and which in my "boyish days" consisted of meadows and market gardens. There we used to see them in vast flocks, shifting about in compact masses, and uttering a pleasing but confused song, as soon as they alighted on the hedgerows and bushes, from which, on the slightest alarm, they would take wing, and in their progress mingle sundry call-notes with small snatches of song. On the other hand, the greenfinch (*Loxia chloris*, Linn.) has always been known to me as less gregarious in its habits than the redpole, or, indeed, any other of the finches; and though it is a resident, it is only as a winter visitant I have had opportunities of observing it sufficiently to become familiar with its habits. It is a beautiful and lively bird, no whit less attractive in habit and song

than the goldfinch or the chaffinch, birds of no mean repute; but, unfortunately, the call-note of the greenfinch is abominably harsh, and so piercing, that it may be heard at a greater distance than the call of any other bird, and is often useful as a warning to birds of other species, as well as to the individuals of the flocks of half-a-dozen or so which frequent the London gardens during the winter.

Thus, in spite of its being true that the winter has few songs, I have, I hope, shown that it has some music to cheer the heart of man, and encourage the observer to continue the search for knowledge, even when the opportunities for its acquirement are few and far between. Nor is the list of winter song-birds exhausted. The crossbill occasionally appears, in company with the hawfinch, in our pine woods; and these are the two most interesting of all the rarer birds of Britain. Great is my debt to them for amusement freely afforded by their pranks and melody, when they have figured among my household pets, as greatly prized as any. There is the siskin, also rare, but liveliest of the lively—a bird with a merry heart and a vein of comic humour quite in keeping with the queer character of its twitter of a song. And if all these were silent, we should have the sparrow and the robin, friends that fail not, that a hard winter never annihilates, and that seem to be of kindred, morally, with the redoubtable Mark Tapley, for they are "jolly" under circumstances the most adverse to merriment. But why mention them together? they are no friends, and the first is but a chattering thief, while the other is the bravest, the most individual, independent, jovial, and melodious of all the winter minstrels. No wonder the robin is the most renowned in story, and the most sacred in the household mythology, for his mellow song is like a ray of sunshine during a season of darkness, or, as Emerson says, speaking of things altogether foreign to this subject, "like music heard out of a workhouse."

SALT MARSHES AND THEIR INHABITANTS.

BY GEORGE S. BRADY, M.R.C.S.,

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THERE are in our comfortable land few scenes more dreary and depressing than an extensive salt marsh, especially if seen under unfavourable conditions of weather. The monotony of a vast expanse of moorland is broken by undulations of its surface, by the purple flush of heather, or the golden glow of blossoming gorse; and even if there be none of these it becomes grand rather than dreary in its very immensity, and the ever-varying play of light and shade upon its many-tinted vegetation, gives it an indescribable charm. But let us change the scene. Picture to yourself a bare expanse of cold, oozy soil, clothed with scanty, stunted vegetation of a dull grey-green hue, with patches of treacherous mud, into which one may very easily sink up to the knees before one has time to invoke the shade of "Jack Robinson" (whoever that mysterious worthy may have been); here and there a sullen, shallow, brackish pool, with bottom of black peat or mud; bits of old worm-eaten wreck strewed about, and sinking month by month deeper into the unstable soil; cast off shells of shore-crabs bleaching in the sun, and crunching beneath the infrequent footstep; no sight or sound of life except a few sea-gulls or lapwings circling overhead, and only adding to the "eeriness" of the scene by their melancholy cry. All this is sufficiently doleful, and with a dull leaden sky, and the breath of a chill sea wind, one has need of a considerable share of the spirit of Mark Tapley to keep "jolly" under the circumstances.

However, to the naturalist there is abundant interest in localities such as these. Though the vegetation is so poor and stunted, we find on closer inspection not a few interesting and peculiar plants, and we are at once struck with the fact that many of them are remarkable for their excessively fleshy and succulent leaves. Perhaps the commonest of all is *Glaux maritima*, a modest little plant with pretty but inconspicuous pink flowers, or rather, we should scarcely say *flowers*, for petals are wanting, and the apparent flower is merely the flesh-coloured calyx. Then there is *Salicornia herbacea*, with its thick, tumid leaves, which often obtain for it, though incorrectly, the name of Samphire; the true Samphire (*Crithmum maritimum*) being essentially a rock-loving plant and growing often in the most inaccessible positions, as Shakspeare well knew:

"Half way down
Hangs one that gathers samphire, dreadful trade:
Methinks he seems no bigger than his head."

More showy than these is *Aster tripolium*, which, with its mauve petals and brilliant orange disc, does the best it can to lend some liveliness to its chosen haunts,

"Making a sunshine in a shady place."

Some of the *Arenariæ*, too, we may find (*A. marina*, or *A. peploides*), not without a quiet beauty of their own, but certainly less attractive than their rarer neighbour the Sea Lavender (*Statice limonium*), which, with its beautiful spikes of blue and white, is after all not so lovely a flower as its near relative, the common Thrift (*Armeria maritima*). Thrift flourishes nowhere so well as on cliffs overlooking the sea. The Preraphaelite artist could scarcely find a more delightful study than a luxuriant bed of this plant carpeting the sides of a rugged rock, its glow of tender crimson intermixed with the beautiful white of the Sea Catchfly (*Silene maritima*). But we find it likewise growing freely in the salt marsh, on the mountain-top far inland, and under cultivation in our gardens. It seems, indeed, to be one of the most hardy and accommodating of our indigenous plants. We might much prolong this list of flowering plants peculiar to, or very common inhabitants of, salt marshes, but must dismiss them with the mere mention of the genera *Atriplex* and *Plantago*, both of which will commonly be found represented. The Cryptogamic flora, however, deserves further attention. In the spongier parts of the marsh we find the roots and rhizomes of the grasses matted together by a dense growth of *Vaucheria*, one of the green Algæ of a genus which inhabits indiscriminately fresh, brackish, and salt water. The plant puts on many different forms and habits, according to the kind of locality in which it grows, and many of these varieties have been elevated to the rank of species on very insufficient grounds. *Vaucheria* is certainly one of the least beautiful, perhaps also one of the least interesting of its class. It consists of branched tubular filaments, filled with a green endochrome, and without articulations. The filaments are mostly inextricably matted together, forming a dense cushion, so that the base of the tuft being excluded from the air and buried in mud, becomes yellow and gradually decays, while the upper extremities, continuing their growth, are of a deep bluish-green colour. The only situation in which we have ever seen any member of the genus put forth much pretension to beauty, is on the sides of perpendicular rocks, where it is nourished by the spray of waterfalls or runlets. In such places its green velvet fleece, often many

yards in extent, disposes itself in numberless tiny crests and undulations, which give an effect of exceeding richness to the rock surface. This plant is *V. cæspitosa*, that of the salt marshes, *V. velutina*. While speaking of Vaucheria we may briefly allude to the remarkable fact that living animals (*Rotifera*) have been repeatedly observed in the interior of the filaments, nor is there much difficulty in accounting for their presence in so unwonted a situation. When the tube of the plant ruptures to allow of the escape of a spore, or from any other cause, the opening so formed would be amply sufficient to allow of the ingress of a rotifer, either as an egg or in the mature state, and when once established in the filament there is nothing to prevent the animalcule breeding *ad libitum*, so that plants have been observed to be completely colonized by Entozoa of this kind. Intermixed with the marsh Vaucheria we often find a species of Oscillatoria, an alga composed of slender, unbranched, tortuous threads, which are faintly marked by close transverse striæ. Its filaments are of microscopic dimensions, being only one two-thousandth of an inch in diameter, and when viewed under the microscope they exhibit plainly the peculiar oscillatory and worm-like motions from which the genus derives its name. The origin of these movements is not thoroughly understood. They had been supposed to be due to ciliary action (a very convenient explanation by the way, of all sorts of anomalous, ill-understood movements), but are more probably referable to some contractility inherent in the tissue of the plant, perhaps analogous to that which we see in the sarcode of Rhizopoda, etc. At all events, no cilia adequate to produce such motions have yet been detected in Oscillatoriæ, and the motions themselves are very different in character from those which we know to be caused by ciliary action, such as the rotation of Volvox and the spores of many algæ. I am at a loss to conceive how any observant scientific man could explain these motions (or attempt to explain them), as Dr. Hassell has done, in the following words:—"The phenomenon of oscillation is due to a certain degree of elasticity belonging to the filaments, which leads to the effort, on their part, whenever, as on being placed for observation on the field of the microscope, must be the case, they are bent or put out of a straight line, to recover that position which is natural to them. This elastic property of the filament currents, almost imperceptible in the liquid in which they are immersed, and perhaps unequal attractions amongst the filaments themselves, are causes amply sufficient to explain any motion which I have ever witnessed amongst the Oscillatoriæ, and which motion I cannot help thinking to have been misunderstood and exaggerated to such an extent, as to throw around these plants

an unnecessary degree of mystery." A very simple observation would have shown Dr. Hassell that these motions take place naturally during the growth of the plant, and while it is free from any of those disturbing causes alluded to. Indeed, it is by these motions only that we can explain the very rapid spreading of the filaments over a large surface, which phenomenon may be easily witnessed both under natural and artificial conditions.

The oscillation is seen even more beautifully in a nearly allied genus, *Spirulina*, which may occasionally be found spreading over decaying leaves and other organic matters in brackish water, or in the sea near high-water mark. The plant itself is also much more elegant than Oscillatoria, consisting of a slender filament, twisted closely upon itself so as to resemble a very delicately threaded screw of a beautifully delicate green tint. Another very curious organism of the same group, and occurring also, though much more rarely, in salt marshes, is *Microcoleus anguiformis*, which may be described as consisting of a number of short threads of an Oscillatoria packed together into a bundle and enclosed in a tubular sheath, wide and open at one extremity, pointed and closed at the other. Out of the open extremity the threads protrude and oscillate, or they may even exhibit themselves from a rent in the side of the sheath.

If we scan closely the bottom of one of the black uninviting pools before-mentioned, we shall probably find that it is marked in patches, or it may be all over, with small closely-set holes, each of which opens at the apex of a slight eminence. The tubes with which these perforations communicate are, in fact, the habitations of a curious Amphipodous crustacean (*Corophium longicorne*), but whether they are really the work of the Corophium, or are merely taken possession of by the creature, as a hermit-crab takes possession of a deserted shell, is not so easily decided. I believe that the tubes are mostly excavated by a small annelid. At any rate, whole colonies of annelids may often be found inhabiting them. There is no doubt, however, that the Corophium has the power of burrowing very rapidly into soft mud, and it makes use of this faculty whenever it is alarmed and wishes to conceal itself; probably also when pursuing its prey. But though I have kept specimens in confinement for several days I never could find that they formed any regular tubes like those which we see them inhabiting in their natural haunts. There is a traditional enmity between Corophium and the Annelids, and it is quite possible that it may, after killing the architects, take possession of their burrows. So indeed, Pagurus has been said (but not proved) to do with the molluscan builder of its appropriated habitation.

XUM

Corophium longicorne is most commonly met with in the mud of brackish ditches, flat sea-shores, and estuarine swamps, but if the following passage from Quatrefages' "Rambles of a Naturalist" may be trusted, it would appear to be an animal of migratory habits. "Towards the end of April these little crustaceans, termed by the fishermen of the coasts of Saintonge, the *Pernis*, arrive from the open sea in myriads. Guided by their instinct, they come to wage an exterminating war against the Annelids, which during the whole winter and early spring have multiplied undisturbed. As the tide rises these voracious hordes are seen moving about in all directions, beating the mud with their long antennæ, and pursuing Nerides and Arenicolæ to their deepest recesses. When once they discover one of these animals, which are several hundred times larger than themselves, they combine to attack and devour it, and then resume their eager chase. This carnage never ceases till the Annelids have almost entirely disappeared. . . . . Before the close of May the work is completed, and then the Corophium turns upon the molluscs and fishes, which it attacks, whether living or dead. Through the whole of the summer these crustaceans remain upon the coast, but towards the end of October they all disappear in one night, ready to return the following year."* To this account we may add that in some places, far removed from tidal influence, where we commonly find these little crustaceans, the migration spoken of cannot possibly take place. Probably the habits of the creature may vary according to the circumstances in which it is placed.

Another Amphipodous† crustacean, constantly met with in the pools of salt marshes, is *Gammarus locusta;* certainly not an animal of beautiful or interesting aspect. Its dull brown or greenish colour, its wriggling sideways motion when taken out of the water, and its habit (shared by other members of the family) of hanging together in couples, the large male carrying the smaller female about beneath him, holding her by his claws; all these give the creature a certain repulsiveness. Nevertheless, there are several very interesting points to be observed respecting it. In the first place, this genus (*Gammarus*) may be said to be the type of the whole class of crustacea. In it the several parts of crustacean organization are developed in the most symmetrical and orderly way, and may be separated and demonstrated, perhaps, more completely

* Quatrefages' *Rambles of a Naturalist on the Coasts of France, Spain, and Sicily*, vol. ii., page 312.

† The *Edriopthalma*, or sessile-eyed crustacea, are sub-divided into *Amphipoda* and *Isopoda*, the former being compressed laterally, and having feet adapted both for swimming and walking; the latter are flattened horizontally, and are specially formed for running. Of the first named group, the common Sand-hopper may be taken as the type; of the latter, the wood-louse or "Slater."

than in any other genus. The segments of the body and their corresponding appendages may be seen very clearly, there being little or nothing of that pressing together and consolidation of several parts which is so constantly exhibited in both the higher and lower orders.* We should scarcely expect to find in an animal of this grade much development of maternal instinct, and yet some observers have noticed such manifestations. The ova of crustacea are mostly attached in a considerable mass, to the abdominal or false feet of the female. In *Gammarus* (and in some other genera) they remain *in situ* for some time after having taken on the crustacean form, and even when able to swim freely, they will often hover round the parent in a little cloud, and when any danger threatens, again seek refuge amongst her legs. *G. locusta* is easily recognized by three conspicuous red spots on each side of the body, upon the abdominal segments. It is a very common species, but is almost confined to the upper portion of the littoral zone, haunting chiefly shallow tidal pools, and especially those heaps of decaying seaweed which strew the shore between tide marks. In such situations it may often be found in countless numbers. Its range extends up tidal rivers to the utmost verge of brackish water, and it may even be met with in ditches to which salt water gains access only once or twice in the year.

A species of Sphæroma (*S. rugicauda ?*) is one of the most generally distributed crustacea of brackish water, and is, indeed, almost the only representative of the Isopods met with in such places. The species of this and some allied genera (*Armadillidium, Porcellio,* etc.) have the curious habit of rolling themselves into a little ball when handled, remaining motionless while in this position. The terrestrial species have obtained for this reason the trivial name of "pill beetles." It is remarkable that some of these animals are able to live indifferently, either in the deep sea or on dry ground removed from any marine influence. Thus we have taken *Porcellio scaber* abundantly on dry sandy hedge-banks, and likewise from the nets of trawlers in fifteen fathoms water. Such a fact is very curious and suggestive, quite as much so as many of the hypothetical cases put by Mr. Darwin in his work on the "Origin of Species," and which have been so much ridiculed by the opponents of his theory.

Among the Entomostraca of salt-marshes we find some very interesting species. One of the bivalved forms (*Cyprideis torosa*) was first described by Professor T. Rupert Jones, as a fossil species occurring in the Tertiary strata. Mr. Jones likewise took it living in ditches near Gravesend, and it has since been

* For an account of the structure of the skeleton of a typical Crustacean, *vide* INTELLECTUAL OBSERVER, vol. iii., page 38.

XUM

found abundantly in both fresh and brackish waters in the counties of Somerset, Durham, and Northumberland.* When it does occur it is generally in prodigious numbers; a fact accounted for by the unusually large number of ova which it bears. The peculiar ringed and serrated hairs which occur on the limbs of this genus and of *Cythere* are very beautiful and interesting objects for the microscope.

Cyprideis has no power of swimming, its motions being restricted to crawling; but some of the natatory Entomostraca are found in similar places. These are chiefly of the same family to which the common and well-known *Cyclops quadricornis* belongs. The males of these animals have the right antenna very strongly developed, and provided about the centre with a hinge-joint, so that it can be flexed and used as a clasping organ. In some species, to render the apparatus still more effectual, there is on each side of the hinge a plate armed with spines or serratures, by which the grasp must be greatly strengthened. The females may be seen toward the end of summer and autumn, carrying about with them, attached to the first segment of the abdomen, numbers of elongated cylindrical, or fusiform bodies of a yellowish or deep red colour. These are the "spermatic tubes," which have been fixed in that situation by the male; a curious mode of fecundation, which so far as we know is peculiar to this family of Entomostraca.

The highest, or stalk-eyed order of Crustacea, is represented in brackish water by three species—*Palæmon varians*, *Mysis vulgaris*, and the common shrimp (*Crangon vulgaris*). The last named is of almost universal occurrence, and calls for no special remark here; the other two species are comparatively rare. The Palæmon is much smaller than its congener, *P. serratus* (the common edible prawn), and also quite deficient in the beautifully variegated colouring which adorns that species. Like the rest of its genus, it is very timid and very agile, so that, except with a tolerably large net, it is difficult to catch it when in clear water. In muddy places the best way of getting specimens is to force the net into the mud, so as to enclose a considerable quantity; then on washing it a number of the prawns will probably remain behind. It is curious that although these creatures seem so much frightened at the sight of a net, they will, if one's hand is put quickly into the water and kept there for a minute or two, come boldly up to it, hovering about, and feeling it all over with their long antennæ. A crowd of them may be thus collected in a very short time, but the slightest movement makes them dart off rapidly, and I have always found it impossible to catch one in this way, even though

* *Vide* a paper by the present writer in *Annals and Magazine of Natural History*, January, 1864; also in INTELLECTUAL OBSERVER, vol. i. p. 454.

they will sometimes come and bask almost in the palm of the hand; probably the warmth of the hand is the attracting influence.

The species of Mysis, or "Opposum shrimp," mentioned above, living as it does both in fresh and strongly brackish water, brings before us a very interesting problem, and one by no means easy of accurate solution, yet concerning which we have some few data which may guide us to a right result. We find that most fresh-water genera possess also some representatives inhabiting the sea. And it at once strikes us that it must be something more than a merely fortuitous coincidence by which animals so far separated in their habits agree so closely in structure as to be included in the same genus. If Mr. Darwin is right, as we believe he is, in supposing that at least all genera of the same order are descended from one common ancestor, we must seek for an explanation of the present state of things by looking backward to some remote period when the progenitors of the existent fresh water and marine forms were not separated by the impassable barriers which now divide them. We extract the following interesting remarks on this subject from Messrs. Spence Bate, and Westwood's History of the British Sessile-eyed Crustacea (vol. i. p. 390). With reference to the facts which we have mentioned, these authors say: "The key may be suggested by the interesting discoveries of Cedarström, Ölofson, and Widigrew, in the lakes of Vetter and Vener, in the south of Sweden, of which an account has been published by Lovèn. These two inland fresh-water lakes are situated on high ground, and have the surface of their waters 300 feet above the level of the Baltic, whereas the bottom is 120 feet below such level. In these lakes (which appear to have been lifted up with the gradual uprising of the country) have been found several genera and species of Crustacea, three of which are Amphipoda, which are affirmed to be identical with marine ones, namely, *Gammaracanthus loricatus* (Sabine, Ross, Kröyer), *Pontoporeia affinis* (Lindström), and *Gammarus cancelloides* (Gerstfeldt). The first is now only known to exist in the Arctic seas, the second in the Baltic, and the last was found in Lake Baikal, in Central Asia. It is therefore suggested by Lovèn that when the land was raised so as to convert these waters from marine bays into inland lakes, these marine species were retained within the basins, the waters of which have since been changed, through the agency of springs, into fresh-water; and with the gradual transfer of the water the habits of the animals have also changed gradually, and that without any outward alteration of form. Professor Lovèn thinks that there is sufficient evidence to show that this change in the conditions of these lakes must have taken place during the great glacial period, at a time when the animals now found in

XUM

it (and which are known at this day to inhabit only the extreme north) could have lived in the same latitude as the south of Sweden. The evidence of these fresh-water lakes suggests that similar changes in the relative position of sea and land may have been the cause of our having fresh-water Crustacea nearly allied to marine species in our rivers and inland streams."

Higher in the scale of life the inhabitants of salt marshes are few and far between; a few sticklebacks and an occasional gasteropodous mollusc of some common species will almost exhaust the list. We should not, however, pass entirely without mention a very interesting nudibranchiate mollusc, which has been found in a few places. This is *Alderia modesta*, a pretty little species of a greenish colour, living chiefly among the tufts of Vaucheria, upon which it feeds. Where it occurs at all it is mostly in great abundance; but the only British localities hitherto recorded are Lougher Marsh, near Swansea, a marsh near Cork, and Hylton Dene, near Sunderland. Associated with it may sometimes be found a little black slug of the genus *Limapontia*.

Salt marshes such as these, whose inhabitants have been the subjects of our paper, are perhaps the nearest analogues which our islands can now exhibit of those extensive lagoons which, under the fostering influences of an almost tropical climate, supported the dense forests of the Carboniferous period. It has been inferred from certain animal remains found in the coal strata, that those lagoons must have been, in some cases at least, brackish; but considering the widely different aquatic conditions under which it has been shown that the same species may exist, too great caution can scarcely be exercised in the application of any evidence derived from fossil remains.

OPTICAL GHOSTS.

The old mode of obtaining spectral illusions by means of concave mirrors presented many difficulties, which were practically insuperable when the images were required to be on a large scale, and to be comparable in sharpness and apparent density with actual and similar objects seen at the same time. Lately these difficulties have been wonderfully overcome, as the "Patent Ghosts" exhibited at the Polytechnic, and elsewhere, abundantly testify. So great has been the popularity of these exhibitions that, now the mystery is out, and an explanation is offered by Mr. Dircks to the public, the book* purporting to reveal the secret would have been widely welcomed had it

* *The Ghost, as produced in the Spectre Drama*, Popularly Illustrating the Marvellous Optical Illusions, called the Dircksian Phantasmagoria, by Henry Dircks, C.E. *Shaw.*

been better written, and confined to its legitimate subject. Mr. Dircks complains of others, and probably with reason; but about quarrels of this kind the public care little, and when they pay their money for the little book entitled "The Ghost as Produced in the Spectre Drama, by Henry Dircks, Civil Engineer," they do not expect to find nearly all of it devoted to a partially intelligible account of grievances with which they have nothing to do. The amount of explanation given will prove provokingly small, and, to those unacquainted with optics, of little use; while those who are familiar with that science did not want it at all. Mr. Dircks' merit in the patent ghost business appears to consist in the fact that he saw how to utilize the long-known principles involved in the neutral tint reflector, used by microscopists as a substitute for the more expensive *camera lucida*. In this instrument a little plate of thin glass is placed so that the eye looks at it at an angle of 45°, and receives the reflection of the image which the microscope forms of the object on the stage. Thus the eye is affected, not quite so strongly, but just in the same way as if it had looked straight down the microscope tube; and if a piece of white paper is held below the reflector, the object will appear projected upon it, and the eye can, in addition to receiving the reflection, look through the glass and see the hand and pencil by which the outline is traced.

To make this kind of action plainer, let a few simple experiments be performed, and let the reader remember that the angle of incidence is always equal to the angle of reflection, and that objects seen in a looking-glass seem just as far behind it as they are actually before it. If any of our young readers do not distinctly understand the angle of incidence question, they can easily resolve it with marbles or bagatelle balls. Let them place a box, with square sides, on the table, and make a chalk line, so as to form a perpendicular to one of its sides, and falling on the centre. Then, if a marble is bowled against the box so as to strike it slantingly on one side of the perpendicular, it will be thrown back in a similar slant on the other side of the perpendicular. The rays of light behave like the marble or bagatelle ball in this respect.

For our first experiment, take a hand looking-glass, and see your face in it; then incline the bottom of the glass *away* from you till your face is quite ost, and then your body, or hand, if in the way, will appear plainly. You lose sight of the reflection of your face because the angle of the rays from it which fall upon the glass is such that the resulting angle of reflection sends them away from you. You see your body, or hand, because the angle of their incident rays is such that the resulting angle of reflection carries the image straight to your

XUM

eyes. Old writers were well aware of the fact that a plane mirror could be so arranged that a person looking at it should not see himself, but see something else, which might be behind a screen, and quite out of his natural view. It is, indeed, very easy to make a looking-glass show you objects quite out of your line of vision, and one of the facets of a moderate-sized diamond will easily enable you to see by reflection any object in a room, when you appear only to be looking at the finger that carries the ring in which it is set.

Having made a few experiments with the looking-glass, take a pane of window glass, or, what is better if you have it, a piece of plate glass, the surface of which is more true, and hold it upright on the table near a window. A few inches in front of it place any small object on the table; a lady's cotton reel will do extremely well. Stand upright with your back to the window, but leave room for the light to fall freely on the top of the reel. Look slantingly down at the glass, and you will see the image of the reel reflected by its surface, and apparently as far behind as it really is before. The top on which the light falls will be brilliant, and the part that is in the shade will be reflected in shadow. Vary the experiment by placing a second reel, exactly like the first, as much behind the glass as the other is placed in front of it. You then have two reels presented to your eye, one actual, and the other spectral, and you can, as Mr. Dircks remarks of a similar case, so arrange the objects, and your position, that the image reflected from the surface of the glass shall exactly correspond with the outlines of the real reel seen *through* the glass. If you put any small article on the top of the reel in front of the glass, or some one else puts a similar object on the top of the reel behind the glass, the optical effects will be the same.

Now make a third experiment. Put a box, or thick book, in front of you, so that you cannot see the reel, when placed on the table just under its edge. Then hold the glass a little way off, and upright as before, so that you see it from top to bottom. You may then obtain a reflected image of the reel, which the book conceals, and if a strong light were thrown upon it, the image would be as sharp, distinct, and apparently solid as the reality.

Thus this kind of optical ghost is very easily made, and Mr. Dircks suggests a few effective tricks. We have not dwelt at any length upon verbal explanations, because everybody can make the simple experiments suggested, and they will explain the matter much better than a lengthened essay could effect. We ought, however, to add, that Messrs. Horne and Thornthwaite supply a portable apparatus, by which the Dircksian ghosts can be easily and strikingly shown.

Mr. J. H. Brown, acting upon another set of optical principles, offers us "Ghost's Everywhere, and of any Colour."* We need not stay to comment on the explanatory part of this volume, but proceed to the pictures, which are drawn and coloured so as to excite similar images on the retina in accidental colours. Our readers have no doubt often tried the experiment of sticking coloured wafers on a sheet of white paper, holding them a strong light, and staring at them fixedly for a few seconds. If this is done, and the eye then taken off the wafer, and turned on to the white paper, the wafers' image will appear sharp and distinct, but in another colour. A red wafer will look green (or blue and yellow combined), a blue one orange (or red and yellow combined), a yellow one purple (or blue and red combined), and wafers of composite hues will be affected in an analogous way. These "spectral," "accidental," or "complementary" colours—for they are known under these three appellations—appear bright to the eye in proportion to its sensitiveness to the original colour, to the strength of the illumination, and to the steadiness with which the original object has been contemplated. Mr. Brown finds the time occupied in counting twenty, or about a quarter of a minute, sufficient to impress his figures upon most eyes, if the plates are well lit up. His directions are to look steadily, for the time specified, at a dot or asterisk to be found in each plate, "the plate being well illuminated by either artificial or day light. Then turning the eyes to the ceiling, the wall, or the sky, or, better still, to a white sheet hung on the wall of a darkened room (not totally dark), and looking rather steadily at one point, the spectre will soon begin to make its appearance, increasing in intensity, and then gradually vanishing, to reappear and again vanish."

The Brownian spectres depend upon the tendency of strong impressions to remain a little while upon the eye, and to reappear in accidental colours. The plates are certainly very effective, and well designed for the purpose; but we should recommend an avoidance of needless horrors in future series. The grotesque and the beautiful will both work just as vividly as the ghastly, and several objects in the present series could not be judiciously introduced to the notice of boys and girls whose disposition was nervous, or whose superstitious feelings had been excited by injudicious nursery tales.

Mr. Brown's direction to enlarge the spectral appearance by looking for it on a white sheet, or wall, some distance

* *Spectropia, or Surprising Spectral Illusions*, showing Ghosts Everywhere and of any Colour, by J. H. Brown. First series, with sixteen illustrations *Griffiths and Co.*

XUM

off, is very ingenious, and brings us back to the microscopic neutral tint reflector with which we started. This reflector enables drawings to be made much larger than the actual image which the microscope transmits to the eye. Suppose, for example, the image represented an insect one inch long, and the draughtsman tried to sketch it with a long pencil on a sheet of paper placed on the floor, he would have to make a picture on the floor as big as an object must be to equal in apparent size a far smaller object nearer the eye. This may be made plain by a diagram, and plainer by an experiment. Take, for example, a sixpence, and hold it at such a distance from the eye that its diameter exactly equals that of a large picture across the room. Then the sixpence, at so many inches, and fractions of an inch, from the eye, looks as broad as the great picture so many feet off. For a second illustration, hold the sixpence steadily in front of the eye, about six or eight inches off, and let some one else stand by the wall and make a mark corresponding with the circular space the sixpence hides. In this case the great circle, so many feet or yards off, is equivalent to the little sixpence at six or eight inches off. In the instance of the image reflected by the neutral tint glass used with the microscope the pencil was employed to trace out an outline that would be equivalent to the reflected image seen much closer, and in Mr. Brown's enlarged ghosts, the optical image takes the size of his plates, as they appear at a convenient distance from the eye, but they *seem* as big as they would look if drawn on a larger scale on the wall on which they are *fancied* to appear.

THE RUINS OF COPAN.

In our number for May, 1863, we gave a beautiful view of an enormous sculptured monolith from the pre-incarial ruins of Tia Huanaco in Bolivia, formerly Upper Peru, accompanied by a paper, in which Mr. Bollaert collected together the very little that is known concerning this kind of work. The whole subject of American antiquities is under a dense cloud. We can only make rude guesses concerning the dates of the remarkable remains, or of the extinct and forgotten people by whom they were executed. It is however of importance that accurate representations should be preserved of the principal objects of interest, and for this purpose photography is of great value, and fortunately admits of reproduction at a very moderate price. The Tia Huanaco ruins form a portion of numerous works, extending over a considerable geographical area, and all bearing evidence of having

been produced under similar conditions of knowledge, sentiment, and skill. They certainly could not have belonged to a barbarous age, because they evince a considerable command of mechanical powers, and show an advanced though highly conventional style of art.

Messrs. Smith, Beck, and Beck have recently made a valuable addition to the means of study at the disposal of archæologists, by publishing a highly interesting series of stereoscopic slides, from photographs taken by Mr. Albert Salvin, of the ruins of Copan, Honduras. They comprise richly sculptured stones, that no doubt formed portions of considerable buildings, bearing in their hieroglyphic ornamentation a strong likeness to our Tia Huanaco plate. A careful inspection of the series will show that the artistic skill possessed by the unknown workers in an unknown age was very considerable; and we cannot doubt that some system of mythology, and some facts of curious history lie hid in allegorical representations, which we have no key to unlock.

Mr. Salvin's series of slides are well worth study, and though we are not disposed to waste time in mere conjectures, we cannot relinquish the hope that the clue to this American mystery may yet be found out. We shall not attempt a detailed description of these remarkable objects; but they all belong to the Tia Huanaco type; and we agree with Mr. Salvin in considering that they were associated with the mythology of the people by whom they were wrought. The stone in which they are executed, is a close-grain porphyry, and the preservation of the sculpture has enabled the photographic apparatus to produce excellent and highly interesting copies, on which the labours of the archæologist may not be exerted in vain.

No. 7 of the series represents a very remarkable monolith, 12 feet high. A face, powerfully sculptured upon it, looks much more like a portrait than a conventional figure; the features bear some resemblance to the Mongolian type. No. 20 is an admirable, though conventional, jaguar's head, equalling in force of expression any analogous European work. No. 13 is a circular stone, supposed to be sacrificial. It has a rounded surface, and a border of twisted or cable pattern. There are in all twenty-four slides, accompanied by a descriptive pamphlet.

XUM

RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE KEW OBSERVATORY.

LATITUDE 51° 28′ 6″ N., LONGITUDE 0° 18′ 47″ W.

BY G. M. WHIPPLE.

1863.	Reduced to mean of day.					Temperature of Air.			At 9·30 A.M., 2.30 P.M., and 5 P.M., respectively.		Rain—read at 9·30 A.M.
			Calculated.								
Day of Month.	Barometer, corrected to Temp. 32.°	Temperature of Air.	Dew Point.	Relative Humidity.	Tension of Vapour.	Maximum, read at 9·30 A.M. on the following day.	Minimum, read at 9·30 A.M.	Daily Range.	Proportion of Sky clouded.	Direction of Wind.	
	inches.	°	°		inch.	°	°	°			inches.
Oct. 1	29·250	54·1	52·6	·95	·408	57·5	50·7	6·8	8, 7, 7	SW, W, W by S.	·379
„ 2	29·788	51·7	49·0	·91	·361	55·5	48·2	7·3	10, 10, 10	SW by W, SW, SW.	·148
„ 3	29·877	56·9	55·7	·96	·453	59·8	50·9	8·9	10, 10, 10	SW, SW by S, SW by S.	·050
„ 4	...	...	...	...	...	63·4	57·5	5·9	...	...	·005
„ 5	29·952	48·6	47·0	·95	·337	55·3	37·6	17·7	7, 10, 10	WSW, S, SSE.	·005
„ 6	29·946	46·5	37·3	·73	·240	52·2	37·2	15·0	0, 4, 9	NW by W, NE, ESE.	·017
„ 7	29·660	53·3	51·7	·95	·395	58·1	40 3	17·8	10, 10, 10	E by S, E by N, E.	·011
„ 8	29·550	57·7	54·6	·90	·436	63·3	53·6	9·7	5, 3, 10	E, E, E.	·293
„ 9	29·558	51·4	44·8	·80	·312	56·8	49·3	7·5	10, 3, 1	E, S by E, SE by S.	·006
„ 10	29·649	57·3	48·9	·75	·359	61·3	46·8	14·5	9, 10, 9	S by E, SE, ESE.	·000
„ 11	...	...	...	...	...	59·5	52·2	7 3	...	... ...	·034
„ 12	29·445	53·3	50·3	·90	·377	58·0	47·6	10·4	6, 3, 1	S, SE, SE by E.	·003
„ 13	29·326	52·2	48·5	·88	·354	57·7	49·4	8·3	10, 9, 1	S, SSW, S by W.	·035
„ 14	29·630	55·9	50·4	·83	·378	61·1	50·0	11·1	6, 7, 2	S by E, S, S.	·130
„ 15	29·576	52·9	53·0	1·00	·413	57·8	49·0	8·8	10, 10, 10	—, —, —.	·026
„ 16	29·859	53·0	49·7	·89	·369	58·1	48 6	9·5	3, 4, 5	SW, SW, SW by S.	·124
„ 17	30·005	53·8	46·5	·78	·331	58·7	48·2	10·5	6, 2, 7	W, WSW, —.	·009
„ 18	...	...	...	...	...	59·0	43·0	16 0	...	... ...	·004
„ 19	30·065	55·5	54·3	·96	·432	59·7	54·7	5·0	10, 10, 10	SW, SW, SW.	·000
„ 20	30·064	53·4	52·9	·98	·412	58·1	53·2	4·9	10, 10, 10	SW by S, NNW, —.	·008
„ 21	30·132	54·1	52·9	·96	·412	60·1	50·2	9·9	10, 7, 7	—, —, —.	·010
„ 22	30·117	55·2	51·1	·87	·387	61·2	51·0	10·2	10, 5, 4	SW by W, WSW, —.	·005
„ 23	30·248	49·5	44·1	·83	·305	55·6	42·6	13·0	1, 1, 2	WNW, NW, —.	·003
„ 24	30·200	44·8	44·6	·99	·310	55·5	32·9	22 6	10, 10, 10	—, E, —.	·000
„ 25	...	...	...	...	...	53·7	33·5	20·2	...	... ...	·000
„ 26	30·020	45·7	43·8	·94	·302	52·3	37·6	14·7	7, 9, 10	—, NE by E, NE.	·000
„ 27	29·920	44·2	41·6	·91	·279	49·4	34·6	14·8	10, 9, 10	—, —, —.	·000
„ 28	29·631	47·9	47·0	·97	·337	54·3	41·5	12·8	6, 10, 2	S by W, SW by S, SW.	·000
„ 29	29·308	49·0	44·9	·87	·313	54·3	42·2	12·1	10, 10, 2	S by W, S by W, SW.	·118
„ 30	29·200	46·1	43·9	·92	·302	53·5	42·8	10·7	10, 10, 2	S by E, S, W.	·146
„ 31	29·499	45·8	34·0	·66	·214	50·8	39·8	11·0	1, 3, 0	SW by W, SW, SW by S	·469
Monthly Means.	29·758	51·5	48·0	·89	·353	...	...	11·4	...	...	2·038

To obtain the Barometric pressure at the sea-level these numbers must be increased by ·037 inch.

HOURLY MOVEMENT OF THE WIND (IN MILES) AS RECORDED BY ROBINSON'S ANEMOMETER—Oct. 1863.

Day.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Hourly Means.
Hour.																																
12 A.M.	17	8	12	20	4	6	6	19	2	18	12	6	11	7	7	11	7	1	21	10	7	4	1	1	8	1	4	1	3	17	19	8·8
1	15	10	14	26	1	3	3	9	13	3	19	10	7	8	10	10	10	2	19	12	5	5	1	1	9	0	2	1	2	15	18	8·6
2	12	12	13	24	2	4	12	13	2	19	15	7	11	6	9	10	10	1	23	15	10	5	2	1	11	0	0	0	2	15	16	9·2
3	12	14	15	18	3	5	17	9	4	16	15	6	16	14	5	10	13	4	18	14	4	6	2	0	14	0	1	0	4	11	18	9·1
4	10	12	17	20	4	6	11	6	15	20	4	6	9	11	6	13	15	6	14	19	5	6	1	2	9	1	0	0	5	12	20	9·1
5	11	18	20	23	1	2	14	11	3	21	16	6	10	5	13	13	13	4	14	13	7	5	3	2	8	1	0	0	9	12	23	9·2
6	10	19	23	0	2	15	21	4	17	20	8	8	10	6	19	10	8	8	16	11	10	4	2	3	8	1	1	1	10	17	28	10·0
7	16	9	27	1	4	15	21	5	18	25	10	11	15	2	15	11	11	11	17	12	10	5	3	3	8	2	1	4	14	20	27	11·4
8	18	8	24	20	1	5	17	25	6	19	24	16	16	2	16	13	15	14	10	5	5	8	3	2	15	0	1	0	7	11	21	11·6
9	16	13	26	24	5	3	15	22	6	19	18	16	15	8	15	13	19	16	10	3	10	10	2	1	20	4	1	1	9	24	27	12·7
10	18	14	27	24	10	5	18	19	6	17	17	15	11	4	16	10	19	19	9	3	8	6	1	2	18	7	1	11	19	25	28	14·0
11	18	12	23	19	10	4	24	20	8	18	17	16	21	24	1	15	18	7	18	7	2	7	8	5	16	3	2	12	27	23	32	13·6
12	15	18	26	19	10	4	26	27	13	16	16	14	21	21	2	13	11	17	15	7	3	6	6	5	16	1	1	7	28	28	31	13·2
1	3	14	25	15	8	2	27	28	10	17	18	21	19	0	14	9	19	18	4	1	6	6	5	5	15	1	2	5	26	22	29	13·3
2	12	13	22	9	8	4	27	32	8	18	13	16	14	1	15	6	18	17	2	1	6	5	3	4	11	2	1	4	24	30	28	12·1
3	11	10	22	7	8	6	23	31	9	16	9	12	12	7	12	10	2	19	20	2	1	2	2	3	12	2	1	5	24	24	25	11·2
4	10	11	23	4	5	5	26	27	6	13	5	12	13	5	10	2	2	15	14	1	1	1	3	2	12	2	2	1	19	18	22	9·5
5	6	10	23	5	6	2	23	23	9	11	5	8	8	6	8	1	1	18	18	2	1	1	1	0	2	3	0	2	15	17	23	8·6
6	4	12	22	4	5	1	23	15	9	15	8	8	8	8	7	6	2	19	18	5	2	1	1	1	6	2	5	1	4	18	21	9·9
7	6	11	25	3	3	4	26	23	11	15	6	8	9	8	5	6	1	25	16	6	5	2	1	0	7	2	5	1	20	19	18	9·1
8	8	11	25	4	3	6	13	17	13	20	6	8	10	8	7	8	2	22	13	3	3	2	1	1	7	1	1	2	22	20	21	9·2
9	5	14	21	2	6	6	11	14	12	15	8	5	12	10	8	9	1	22	21	6	4	2	1	0	6	1	1	1	18	20	21	9·5
10	8	10	29	2	7	5	14	18	15	8	8	5	6	6	9	6	1	25	16	6	5	2	1	1	7	1	1	2	1	18	20	9·5
11	9	11	25	2	5	12	5	15	14	8	6	6	6	9	9	2	2	20	11	3	1	1	1	1	9	1	1	2	0	16	19	8·4
12 P.M.																																
Total Daily Movement.	273	278	523	338	116	92	407	155	185	408	332	564	309	127	281	191	328	403	189	108	107	71	77	236	42	31	94	365	478	581		10·7

RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE KEW OBSERVATORY.

LATITUDE 51° 28′ 6″ N., LONGITUDE 0° 18′ 47″ W.

1863. Day of Month.	Reduced to mean of day. Barometer, corrected to Temp. 32°*	Temperature of Air.	Calculated. Dew Point.	Relative Humidity.	Tension of Vapour.	Temperature of Air. Maximum, read at 9·30 A.M. on the following day.	Minimum, read at 9.30 A.M.	Daily Range.	At 9·30 A.M., 2·30 P.M., and 5 P.M. respectively. Proportion of Sky clouded.	Direction of Wind.	Rain—read at 9·30 A.M.
	inches.	°	°		inch.	°	°	°			inches.
Nov. 1	...	...	...	...	...	48·5	37·8	10·7			·003
„ 2	28·998	43·9	39·5	·86	·260	48·4	39·6	8·8	8, 10, 9	SW by W, SW by W, WSW.	·777
„ 3	29·761	47·8	44·6	·89	·310	52·5	37·8	14·7	10, 10, 10	SW, SW, SW.	·056
„ 4	30·002	56·0	50·4	·83	·378	59·4	42·8	16·6	10, 10, 10	SW by W, WSW, SW by S.	·151
„ 5	30·161	54·9	50·5	·86	·380	57·6	52·8	4·8	10, 10, 10	SW by W, SW by W, SW.	·121
„ 6	30·481	41·9	36·1	·82	·230	45·1	37·3	7·8	5, 5, 4	NE by E, ESE, —.	·044
„ 7	30·155	48·8	48·3	·98	·352	53·4	34·7	18·7	10, 10, 10	S by W, SW by W, W.	·000
„ 8	...	...	...	...	...	52·1	45·4	6·7	...	... ...	·127
„ 9	30·228	43·5	31·9	·67	·198	47·7	41·2	6·5	1, 4, 9	NE, NE by E, NE.	·151
„ 10	29·753	41·0	37·3	·88	·240	45·7	24·4	21·3	10, 7, 3	SW, SW, W by N.	·030
„ 11	29·376	38·5	35·8	·91	·228	43·0	29·9	13·1	10, 9, 2	NE by E, NE by N, N by W.	·014
„ 12	29·939	39·9	34·4	·82	·217	44·7	30·4	14·3	0, 2, 6	N by E, N, N by W.	·022
„ 13	30·269	41·1	37·2	·87	·239	47·0	28·1	18·9	9, 10, 10	SW by W, SSW, SW by S.	·000
„ 14	30·262	47·1	44·7	·92	·311	49·9	28·1	21·8	10, 10, 10	SW, WSW, W by S.	·024
„ 15	...	...	...	...	..	52·4	28·1	24·3	...	... ...	·000
„ 16	30·144	50·7	49·4	·96	·366	54·6	46·0	8·6	10, 10, 4	SW, SW, SW.	·002
„ 17	30·155	49·9	45·0	·84	·314	53·3	47·9	5·4	10, 10, 10	W, W by S, SW.	·000
„ 18	30·234	47·7	43·3	·86	·296	50·0	46·9	3·1	8, 9, 10	S, S, S by W.	·000
„ 19	30·194	46·8	43·0	·88	·293	50·0	43·7	6·3	9, 10, 10	—, SW, SW.	·000
„ 20	30·119	46·7	43·6	·90	·299	50·7	42·2	8·5	10, 3, 1	SSW, S, S.	·000
„ 21	29·678	50·7	48·0	·91	·348	56·3	38·2	18·1	4, 6, 10	SSE, S, S.	·000
„ 22	...	...	...	...	...	50·5	41·2	9·3	...	... ...	·170
„ 23	29·856	48·0	45·0	·90	·314	52·1	41·7	10·4	1, 10, 10	SW, SW by S, SW.	·022
„ 24	29·870	52·4	52·1	·99	·401	55·0	44·5	10·5	10, 10, 10	S, SW, SW by W.	·158
„ 25	30·075	52·2	49·9	·92	·372	55·8	50·6	5·2	9, 7, 10	SSE, S by E, S by E.	·026
„ 26	30·348	49·6	48·6	·97	·356	55·8	44·1	11·7	10, 10, 10	SE, SE by E, SE.	·006
„ 27	30·338	46·6	43·9	·91	·302	49·5	46·2	3·3	10, 7, 10	SE, SE, ESE.	·000
„ 28	30·293	42·6	38·1	·85	·247	46·0	42·9	3·1	9, 3, 3	SE, ESE, SE by E.	·000
„ 29	...	...	...	...	...	44·6	28·8	15·8	...	... ...	·000
„ 3	30·117	36·5	35·2	·95	·223	40·2	28·1	12·1	10, 7, 5	E, NNE, NNE.	·015
Monthly Means.	30·032	46·6	43·0	·89	·299	...	...	11·3	...	... ...	1·919

* To obtain the Barometric pressure at the sea-level these numbers must be increased by ·037 inch.

HOURLY MOVEMENT OF THE WIND (IN MILES) AS RECORDED BY ROBINSON'S ANEMOMETER.—NOVEMBER, 1863.

Day.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Hourly Means.
Hour. 12	19	18	24	20	19	2	3	7	24	3		5	5	5	4	9	12	4	8	1	5	20	9	9	11	4	11	6	7		9·8
1	29	30	23	24	15	4	1	9	21	2		4	3	4	3	8	11	9	9	3	10	20	9	9	7	2	7	7	7		10·0
2	25	20	25	15	7	7	2	11	20	2		3	4	4	13	8	14	12	8	4	11	18	9	8	7	2	4	6	8		10·3
3	15	20	14	24	14	5	8	20	3	0		6	4	6	5	11	14	9	4	4	11	18	5	5	7	2	9	5	3		9·0
4	13	16	18	17	25	16	11	5	22	0	108		8	6	8	8	11	10	5	2	4	19	5	5	8	2	10	7	7		9·4
5	14	16	13	21	15	7	7	3	17	1		4	4	3	5	9	13	8	3	2	9	18	5	5	8	4	9	7	10	187	9·2
6	13	12	10	19	15	7	4	13	19	0		3	2	4	5	9	15	10	3	10	15	15	7	5	7	9	7	5	6		9·0
7	13	14	7	22	14	6	6	15	19	1		4	4	6	6	12	14	12	1	9	11	15	7	7	9	8	8	6	6		9·3
8	12	10	13	19	17	8	4	14	18	3		5	4	6	4	10	14	5	4	8	13	13	8	7	10	7	8	7	2		8·8
9	17	15	14	21	16	10	5	18	17	7	8	5	5	7	5	9	16	6	1	8	16	17	8	7	11	8	10	9	2		10·1
10	22	15	13	23	19	10	7	10	23	13		8	5	7	7	15	19	13	6	10	20	22	11	9	15	12	10	11	3		12·8
11	24	15	11	20	19	7	11	17	23	10	7	13	13	9	7	12	16	8	8	10	21	23	19	14	11	11	11	8	8	3	12·1
12	20	20	16	22	22	6	9	16	20	7	10	11	8	3	3	7	10	16	8	10	21	21	13	13	13	17	12	8	14	3	13·8
1	19	16	15	22	20	3	6	13	20	3	10	8	13	8	11	11	19	16	10	5	23	20	14	8	12	10	8	8	20	14	13·0
2	20	14	19	20	22	4	8	18	23	6	7	8	4	6	6	8	12	13	5	6	27	19	12	9	12	8	6	8	8	20	11·9
3	17	17	20	19	22	2	7	18	12	9	9	9	6	7	4	8	14	8	5	7	31	13	12	11	14	10	6	6	4		11·6
4	12	18	18	23	20	1	7	21	9	8	9	9	6	7	4	6	12	11	6	7	38	12	14	12	9	9	2	6	6	61	11·2
5	9	19	17	26	19	1	7	17	5	6	6	9	7	2	2	7	10	12	7	5	27	13	10	9	10	9	5	5	6		10·2
6	6	22	16	25	18	1	6	22	4	5	4	8	5	2	2	5	12	10	8	2	28	13	9	9	8	12	10	6	4		9·9
7	7	34	16	26	14	0	6	22	2	3	4	5	4	2	2	6	12	9	8	4	25	12	6	9	9	10	12	10	10		10·7
8	11	35	16	25	15	0	9	28	3	3	4	6	4	3	3	8	11	9	9	4	25	12	8	9	9	9	12	8	3		10·6
9	14	30	18	26	9	0	9	25	3	6	6	7	5	3	5	10	9	10	5	2	18	11	7	5	13	15	7	3	3		10·6
10	15	22	20	25	5	0	9	25	4	3	5	4	5	4	5	11	10	12	9	4	20	8	5	12	8	14	9	8	7		10·3
11	22	22	19	21	2	7	4	20	1	3	3	3	4	2	7	5	13	5	3	17	9	9	9	10	9	7	9	6	8		8·8
12																															
P. M.																															
Total Daily Movement.	369	477	389	541	383	105	145	371	346	290	158	127	118	142	228	314	254	142	133	445	377	211	207	246	203	187	145	345			10·3

RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE KEW OBSERVATORY.

LATITUDE 51° 28′ 6″ N., LONGITUDE 0° 18′ 47″ W.

1863. Day of Month.	Reduced to mean of day.					Temperature of Air.			At 9·30 A.M., 2.30 P.M., and 5 P.M., respectively.		Rain-read at 9·30 A.M.
	Barometer, corrected to Temp. 32°.*	Temperature of Air.	Calculated. Dew Point.	Relative Humidity.	Tension of Vapour.	Maximum, read at 9·30 A.M. on the following day.	Minimum, read at 9·30 A.M.	Daily Range.	Proportion of Sky clouded.	Direction of Wind.	
	inches.	°	°		inch.	°	°	°			inches.
Dec. 1	29·696	47·2	46·3	·97	·329	51·1	28·6	22·5	10, 10, 10	SSE, S, S by W.	·006
„ 2	29·122	47·7	42·1	·82	·284	54·1	43·0	11·1	7, 10, 1	S, WNW, W by N.	·211
„ 3	29·329	43·3	27·7	·58	·171	47·7	37·6	10·1	9, 3, 3	W, SW, W by S.	·675
„ 4	30·358	41·4	35·3	·81	·224	47·1	33·2	13·9	0, 10, 10	WSW, SW, S by W.	·006
„ 5	30·105	49·0	43·4	·82	·297	51·3	36·9	14·4	10, 10, 10	SW, SW, SW.	·000
„ 6	...	...	...	...	...	48·2	38·6	9·6	...	...	·063
„ 7	30·365	48·9	43·7	·83	·300	51·0	40·1	10·9	9, 10, 10	SW, SW by W, SW.	·000
„ 8	30·093	48·2	41·8	·80	·281	49·7	45·1	4·6	10, 10, 7	SW, SW, WSW.	·003
„ 9	30·038	47·9	47·0	·97	·337	51·2	45·5	5·7	10, 10, 10	SW, WNW, W.	·056
„ 10	30·225	43·0	39·4	·88	·259	46·7	34·0	12·7	0, 6, 8	SW, SW, SW by W.	·035
„ 11	30·125	48·9	42·8	·81	·291	51·2	38·5	12·7	10, 10, 10	WSW, W, W by S.	·005
„ 12	30·128	51·3	46·7	·85	·333	53·7	46·7	7·0	3, 2, 10	W by N, W by S, W.	·002
„ 13	...	...	...	...	...	48·4	36·4	12·0	...	...	.000
„ 14	30·430	43·2	40·0	·90	·264	50·0	37·9	12·1	10, 2, 1	SSW, W by S, W by S.	·005
„ 15	30·322	44·9	43·0	·93	·293	46·7	33·3	13·4	10, 10, 10	SW, SW, SW by S.	·000
„ 16	29·824	43·8	37·2	·79	·239	49·2	43·2	6·0	10, 8, 7	SW, WSW, W.	·000
„ 17	30·042	43·4	32·3	·68	·201	45·1	37·5	7·6	10, 10, 4	NW by N, NW by N, N.	·003
„ 18	30·484	36·9	29·9	·78	·185	40·9	31·7	9·2	5, 0, 7	NNW, NW, W.	·002
„ 19	30·466	44·6	40·2	·86	·266	48·2	33·4	14·8	10, 10, 10	SW, NW, W.	·000
„ 20	...	...	...	...	...	43·7	31·8	11·9	...	...	·000
„ 21	30·104	44·0	39·5	·85	·260	49·1	36·6	12·5	9, 10, 10	—, WSW, W by S.	·007
„ 22	30·045	35·7	22·0	·61	·140	40·5	39·8	0·7	10, 0, 0	NNE, NNW, NW.	·030
„ 23	30·016	44·0	38·4	·82	·250	48·6	26·4	22·2	10, 2, 1	SW, W by S, W by S.	·000
„ 24	30·228	44·8	40·3	·86	·267	48·1	38·5	9·6	10, 6, 10	WSW, W, W.	·000
„ 25	...	...	...	...	...	48·4	41·7	6·7	...	...	·000
„ 26	29·964	49·4	47·3	·93	·340	51·4	40·9	10·5	10, 10, 10	SW by W, SW by S, SW.	·002
„ 27	...	...	...	...	...	42·6	41·3	1·3	...	...	·002
„ 28	30·277	35·2	32·4	·90	·202	...	28·4	...	10, 10, 10	E by N, SE by E, ESE.	·000
„ 29	29·907	49·5	42·8	·79	·291	52·0	...	...	10, 10, 10	SW, W, W by S.	·003
„ 30	30·120	41·7	36·9	·85	·237	44·5	39·5	5·0	3, 1, 0	W by S, W by N, NW by W.	·000
„ 31	29·779	37·0	34·7	·92	·219	39·9	26·4	13·5	10, 10, 10	E, ESE, E by S.	·005
Monthly Means.	30·061	44·4	39·0	·83	·260	...	...	10·5	...	...	1·121

* To obtain the Barometric pressure at the sea-level these numbers must be increased by ·037 inch.

HOURLY MOVEMENT OF THE WIND (IN MILES) AS RECORDED BY ROBINSON'S ANEMOMETER.—DECEMBER, 1863.

Day.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Hourly Means.
Hour.																																	
12																																	
1	A.M.		23	12	15	14	8	12	30	24	5	12	17	11	4	3	13	15	12	6	2	10	15	8	10	7	15	18	3	7	8	1	11·3
2	A.M.		25	13	9	18	7	14	11	20	6	11	16	5	5	2	13	15	12	6	2	10	22	6	10	5	14	20	1	11	9	4	10·7
3	A.M.		18	15	15	19	7	11	22	18	6	10	17	5	4	1	16	19	12	4	2	9	19	6	11	5	12	18	2	10	9	2	10·8
4	A.M.		27	20	15	17	9	13	20	20	5	11	17	4	5	2	15	17	11	4	3	9	21	9	6	8	13	17	2	10	12	6	11·6
5	A.M.		24	24	11	17	9	14	21	18	8	10	21	5	4	3	18	16	11	5	3	7	20	10	7	9	18	17	1	14	9	5	12·0
6	A.M.	87	25	30	12	18	5	13	20	17	6	8	15	2	4	2	19	14	9	4	3	6	18	12	6	7	16	15	0	13	11	13	11·4
7	A.M.		21		12	20	5	14	19	15	5	10	18	4	2	4	19	18	11	6	2	8	17	13	6	9	20	13	1	11	9	12	11·2
8	A.M.		23		11	21	5	15	19	17	4	12	17	4	4	5	17	19	12	4	4	4	20	14	9	10	18	16	1	11	9	15	11·7
9	A.M.		16	152	9	21	5	16	21	14	5	12	17	3	3	5	17	17	10	6	3	2	20	14	7	8	20	12	0	15	4	15	10·9
10	A.M.		14		13	19	8	17	23	13	9	10	18	3	2	5	19	23	9	5	6	4	26	16	4	9	18	12	2	17	8	12	11·8
11	A.M.	18	14	38	13	23	10	16	21	12	10	14	21	5	6	4	21	20	10	5	10	3	20	16	5	9	19	16	4	21	8	16	13·8
12	P.M.	20	12	40	11	24	12	18	20	9	12	16	22	8	6	5	21	23	10	6	8	3	23	17	7	10	18	14	2	23	6	20	14·4
1	P.M.	21	11	39	12	27	11	22	20	12	15	18	22	8	8	5	23	23	9	11	14	4	19	18	10	13	16	14	5	19	8	19	15·4
2	P.M.	22	13	38	10	25	16	12	25	9	14	22	19	8	8	5	21	22	7	11	11	3	23	16	8	11	15	12	5	23	8	23	15·0
3	P.M.	22	30	39	9	23	11	18	20	4	13	23	21	7	9	5	17	20	4	7	11	8	15	19	6	9	14	11	7	27	10	21	14·8
4	P.M.	22	38	33	10	21	7	18	21	4	14	22	16	7	6	4	14	22	2	6	10	11	7	20	6	11	15	11	4	22	7	21	13·9
5	P.M.	26	32	40	12	22	7	16	19	7	14	20	14	2	4	5	13	20	3	5	8	12	6	19	7	9	14	8	3	16	5	21	13·2
6	P.M.	23	26	35	14	19	8	16	16	5	13	17	14	7	3	7	14	20	5	4	8	6	7	18	4	13	13	5	4	20	3	22	12·5
7	P.M.	23	21	35	15	19	12	16	16	4	12	20	16	6	6	6	14	20	4	5	4	8	6	21	7	11	16	4	4	18	3	25	12·8
8	P.M.	21	17	30	17	17	14	14	14	7	13	16	11	5	3	7	14	18	8	3	7	10	9	16	9	12	17	5	7	17	2	27	12·5
9	P.M.	15	12	32	17	15	10	13	14	3	14	20	10	7	3	10	14	17	6	2	8	9	6	12	4	12	16	4	8	13	2	25	11·4
10	P.M.	9	12	25	18	15	12	15	16	5	13	22	7	5	3	9	12	15	3	3	7	9	6	8	6	14	19	4	11	13	2	25	11·1
11	P.M.	11	11	31	17	10	13	16	19	7	17	26	8	6	3	13	15	17	4	5	10	11	4	11	5	13	13	2	14	11	1	26	11·9
12	P.M.	22	14	27	18	5	11	20	21	5	11	24	14	7	2	13	14	16	5	1	9	11	5	9	5	14	14	1	10	8	4	25	11·8
Total Daily Movement.		362	479	748	316	449	222	369	468	269	244	386	388	134	107	130	393	446	189	124	155	177	354	328	165	238	383	269	101	370	157	401	12·5

RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE KEW OBSERVATORY.

LATITUDE 51° 28′ 6″ N., LONGITUDE 0° 18′ 47″ W.

MONTHLY AND ANNUAL MEANS FOR THE YEAR 1863.

Month.	Barometer, corrected to temp. 32.*	Temperature of Air.	Dew Point.	Relative Humidity.	Tension of Vapour.	Daily Range.	Total Fall of Rain.	Month.	Barometer, corrected to temp. 32.*	Temperature of Air.	Dew Point.	Relative Humidity.	Tension of Vapour.	Daily Range.	Total fall of Rain.
	inches.	°			inch.	°	inches.		inches.	°	°		inch.	°	inches.
January	29·765	42·5	37·4	·84	·244	9·5	2·488	August ...	29·868	61·2	51·8	·74	·402	16·2	1·755
February ...	30·306	43·1	37·4	·83	·244	12·6	0·514	September.	29·818	53·2	45·5	·77	·323	15·9	2·818
March.....	29·879	45·3	36·2	·74	·235	15·3	0·683	October ...	29·758	51·5	48·0	·89	·353	11·4	2·038
April	29·934	48·3	38·9	·74	·259	17·1	0·301	November.	30·032	46·6	43·0	·89	·299	11·3	1·919
May.....	30·002	51·6	41·8	·72	·287	17·1	1·393	December..	30·061	44·4	39·0	·83	·260	10·5	1·121
June	29·863	56·6	47·8	·75	·350	16·6	4·167								
July.....	30·077	62·1	48·9	·65	·364	21·1	0·757	Mean	29·947	50·5	43·0	·78	·302	14·5	19·954

* To obtain the Barometric pressure at the sea-level these numbers must be increased by ·037 inch.

TABLE SHOWING THE MEAN VELOCITY OF THE WIND FOR EACH HOUR OF THE DAY IN THE DIFFERENT MONTHS OF THE YEAR 1863 (IN MILES PER HOUR).

	A. M.												P. M.												
Hour.	12 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	12 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Mean.
Jan.	17·1	16·7	17·2	18·0	17·4	17·0	17·4	17·7	17·3	17·0	17·6	17·1	18·5	18·2	17·5	15·7	16·0	14·7	15·0	15·1	15·3	15·3	16·7	15·6	16·8
Feb.	8·8	8·7	8·0	7·7	8·2	8·5	8·7	8·7	8·5	10·0	11·6	12·2	13·2	13·7	13·0	11·9	11·2	9·7	9·8	10·1	9·6	9·2	9·9	8·9	10·0
March ...	7·8	8·1	8·1	8·1	8·6	7·3	8·7	9·4	10·1	11·4	13·1	14·1	14·4	15·0	14·4	14·3	13·1	10·6	9·4	9·1	8·0	8·7	8·5	7·5	10·6
April.	8·2	7·6	6·9	7·1	6·8	7·4	8·3	10·8	12·2	13·4	13·6	15·0	15·7	15·9	15·7	15·2	14·7	13·7	11·1	10·1	9·0	8·4	7·6	7·5	10·9
May	8·1	7·5	7·6	7·6	7·8	7·4	9·3	12·2	12·6	12·5	13·8	15·0	15·5	16·1	15·4	15·3	15·3	13·7	12·4	10·8	9·5	9·7	10·2	8·4	11·4
June.....	8·3	7·2	7·1	6·5	7·1	7·6	8·4	9·3	10·5	10·8	11·5	12·6	13·5	14·0	13·3	12·6	13·4	12·0	11·3	9·9	8·4	8·3	8·8	8·1	9·9
July.....	4·8	4·1	4·2	4·3	4·4	5·1	6·3	7·6	8·9	9·8	10·5	10·5	10·3	10·1	10·1	9·9	10·5	9·3	8·3	7·5	6·9	6·5	6·2	5·0	7·5
August...	7·3	7·4	7·3	6·8	7·6	7·6	9·5	11·6	12·7	13·7	14·9	15·7	16·0	16·1	15·5	15·2	14·3	13·3	13·1	10·1	8·6	8·2	8·9	7·4	11·5
Sept.	7·3	7·2	7·1	6·7	6·8	6·7	6·8	8·9	10·6	12·3	13·3	13·5	14·5	14·0	13·5	13·1	11·7	10·3	9·2	9·3	9·0	8·1	8·3	7·7	9·8
Oct.	8·8	8·6	9·2	9·1	9·1	9·2	10·0	11·4	11·6	12·7	14·0	13·9	13·6	13·2	13·3	12·1	11·2	9·5	8·6	9·9	9·1	9·2	9·5	8·4	10·7
Nov.....	9·8	10·0	10·3	9·0	9·4	9·2	9·0	9·3	8·8	10·1	12·8	12·1	13·8	13·0	11·9	11·6	11·2	10·2	9·9	10·7	10·6	10·6	10·3	8·8	10·3
Dec.	11·3	10·7	10·8	11·6	12·0	11·4	11·2	11·7	10·9	11·8	13·8	14·4	15·4	15·0	14·8	13·9	13·2	12·5	12·8	12·5	11·4	11·1	11·9	11·8	12·5
Mean.....	9·0	8·6	8·6	8·5	8·8	8·7	9·5	10·7	11·2	12·1	13·4	13·9	14·5	14·5	14·0	13·4	13·0	11·6	10·9	10·4	9·6	9·4	9·7	8·8	11·0

WE NEVER SEE THE STARS.

TAKE a man out into the fields on a calm, quiet night, when the moon is absent, the air clear, and as he looks upward, the "floor of heaven" seems "inlaid with patines of bright gold." Let him see Vega beaming with steady lustre, like a benevolent sapphire eye keeping watch over the world; Capella fitfully flashing; the Bear careering round the silent pole; Orion with his diamond belt; and Sirius blazing in such splendour as to vindicate his title as "the leader of the host of heaven," and leave no wonder that the old Egyptians worshipped him as a sacred orb, and formed the sloping sides of their pyramids that his beams should fall straight and full upon them when he reached his highest point in the skies that over-arched their wondrous land. Let our observer gaze steadily as the smaller stars come out from their homes in the deep unfathomable blue, until, between what the eye sees, and what the mind imagines, the broad fields of space are all alive with light, and, from every point of the compass, stars innumerable seem to gleam. When the eye has thus been filled with brightness, we could scarcely make a more startling assertion than is conveyed in the words, "we never see the stars," and yet no statement can be more true. What then, do we see? The answer is, we see certain rays of light which, in popular phraseology, *left* the celestial orbs some time ago: years ago we know in some instances, centuries perhaps in others, and thousands of years, it may be, in still other cases, and possibly millions might be required to state the time at which, in the remote past, that force was exercised, or vibration excited, by which we recognize the existence of the most distant of those suns whose beams are able to affect our sight. The nearest star is, however, too far off for his light-rays to bring to us a picture of his face. In the moon we see, with the unaided eye, certain indications of the form and character of the surface of our satellite. In the planets, minute discs, in which all features have vanished, proclaim by the low power that makes them distinctly visible, comparative nearness to ourselves; but of the stars another story must be told. They are not like the moon, partly decipherable by the unassisted eye; not like the planets, surrendering more or less of the secret of their form to the glasses of the telescope—they defy alike the eye of the mortal, and the grandest optical machinery which he has been able to invent. They do indeed, in fine weather, look like small regular discs in a telescope, but increasing the power of the eye-piece does not enlarge their apparent diameters as it does that of nearer objects, and in the most perfect instruments they look the least. We see their

RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE NEW OBSERVATORY

XUM

lustre, we note the colour of their light; Betelguese is a topaz, Rigel more of a sapphire, Antares is flushed, and flashes with blood red; and when the telescope has separated the so-called "double stars," we have contrasts of green, orange, blue, white, grey, etc., as Mr. Webb's admirable papers tell; but whether their surfaces are rugged and mountainous, smooth, with plains or seas, diversified in outline, or monotonous in uniformity, we can only guess; for, in spite of all our efforts, *we never see the stars.*

Ordinary objects reveal to us their forms by the effects of light, shade, and colour. They shine with borrowed, and often with feebly reflected light, so that by walking away, we soon lose sight of them altogether. Objects that are more luminous and brighter, show their forms at greater distances, and we often see things negatively that would be unnoticed by their positive effect. Thus a thin rod against a clear sky is seen a long way off, because we are conscious that the sky brightness is, as it were, cut through by some dark thread. But we may pass from all those cases in which light comes to us as a revealer of *form*, to others, in which it says, "I am light," and nothing more.

All "Intellectual Observers" know Longfellow's exquisite poem beginning—

> "The day is done, and the darkness
> Falls from the wings of light,
> As a feather is wafted downward
> From an eagle in its flight:"

and as they repeat the last two lines—

> "We see the lights of the village
> Gleam through the rain and the mist,"

they will recall an experience common to all travellers, the memory of which may bring with it either "a feeling of sadness which the soul cannot resist," or pleasing associations to which the affections cling. These "lights of the village" may help to teach us why "we never see the stars." They come to us like good angels across the moor, or fen, but their faces are hidden from our distant gaze. We do not see the lamp or candle from which they emanate until we are close to it, although we may know what it is, and exclaim with Portia:

> "How far that little candle throws its beams!
> So shines a good deed in a naughty world."

Unless we are tolerably near we do not even see the shape of the flame, and as soon as we have lost that shape, it is, on a small scale, an imitation of the distant stars.

The distance at which objects become invisible, although their light is still seen, varies with different eyes. Without light no man sees; but some men see with less light and much further than others, and long after the longest sighted man has lost all perception of bodily shape, the hawk tribe appear to see it

acutely, so that Tennyson was a true exponent of nature when he depicted the eagle in his home—

> "He clasps the crag with hooked hands:
> Close to the sun in lonely lands,
> Ring'd with the azure world he stands.
>
> "The wrinkled sea beneath him crawls;
> He watches from his mountain walls,
> And like a thunderbolt he falls."

When the sea waves are dwindled down to wrinkles by their distance, the king of birds still perceives upon their shore, objects that would be quite invisible to man; but there is no reason to believe that even the eye of the eagle has ever "seen the stars." The bird, however, may teach us that with perfect visual organs, remoteness would not prevent the discovery of form, but merely reduce its apparent size.

A distant body must have a certain magnitude, in order that its shape may be visible to any eye, with any particular instrument. The larger the body, the greater the distance at which its shape can be seen, under similar and proportionate illumination, but as the distance increases, the apparent size of any body is rapidly reduced, in conformity with a well-known physical law, so that the mightiest celestial orbs may dwindle through remoteness to the merest specks of light which the eye can discern, and by still further remoteness, completely elude the power of the largest telescope.*

We know that the sun's diameter is, according to the best calculations, 850,100 miles, and his distance, by recent determination, about 91,328,600 miles, nearly four hundred times that of the moon. Now the enormous face of the sun, more than one hundred times broader than that of our earth, is eclipsed by a pin's head held near the eye, and it only appears the size of a very small disc held a foot off. Could we pass from our present abode to the more distant planets of the solar system, the great luminary would become smaller and smaller in appearance; and from Neptune, "30$\frac{1}{5}$ times the mean distance of the earth from the sun,"† it would look like a mere point of light that would require considerable magnifying to raise into a disc. Mr. Breen tells us that with a power of 150 we can see the appearance of a disc in Neptune "if we consider it attentively," and the body which thus requires enlarging to the extent of 150 diameters, or 22,500 times superficially, in

* An easy mode of illustrating these facts, is to cut a disc, one inch in diameter, and a triangle (with each side equal to the diameter of the circle), of white paper; stick them against a wall, and walk backwards until the eye fails to see which is the circle and which is the triangle, although two patches of white light will still be discerned.

† Breen's *Planetary Worlds*, page 248.

XUM

order to be seen at all, is 108 times as big as our earth ;* its diameter is 35,000 miles, that of the earth being 7912 miles.

Under ordinary circumstances we do not, without magnifying them, see the real discs of the great planets, otherwise we should need no telescope to teach us that Venus goes through phases like the moon.† When Venus is favourably situated she is a highly lustrous body, that *looks* the same shape as Jupiter, but if the telescope be directed to both, one shows a round face, and the other may appear as a thin crescent of most glorious light. Although the planets are too far off to exhibit real discs to the naked eye, still their being so near in proportion to their size is one reason why they shine with a steadier light, and do not twinkle like the stars. Humboldt and others thought that when light, from one portion of their discs, was for a moment intercepted and then permitted to pass through the air, they did not flicker like stars, because light from other portions of their discs filled up the vacancy that was occasioned, and kept their lustre steadily in view. This cannot be the entire reason of stellar scintillation, as some stars do it much more than others; but whatever action such discs may have, it must lessen, and finally vanish as their distance is increased; and we must not forget that Neptune, the remotest known member of our system, although 2,864,000,000 miles from the sun, is near him, and near us, when compared with the nearest of the stars.

Spectrum analysis bids fair to teach us what the stars are made of, and we may learn more and more of their wondrous ways. Still we may never behold their faces, nor our descendants after us, to the end of time. We place, however, no limits to the future possibilities of science, but the present generation of men, and their long posterity after them, may be compelled to wait for immortal vision before they will really *see the stars*.

* The dimensions and distance of Neptune, and other planets, will have to be revised, to meet the present views of the size and distance of the sun, but this will make no difference in the argument.

† This remark is generally true. Had it been otherwise it would not have been necessary to wait for Galileo with his telescope, in order to learn the fact that Venus exhibits phases like the moon. Mr. Webb, in his excellent work, *Celestial Objects for Common Telescopes*, says, speaking of Venus when near the earth and exhibiting a sharp and thin form:—"This crescent has been seen even with the naked eye in the sky of Chili, and with a dark glass in Persia." Difficult objects become more visible when the mind knows exactly what the eye ought to see, and the eye is practised in looking for it. An easy experiment will illustrate this. Let any one not accustomed to it, look for ϵ Lyræ, which to the naked eye lies close to Vega. The first night of the attempt the small star may not be distinguished, afterwards it will become plainer, and if it is looked at fifty or one hundred times in the course of a month or two, it will seem to have moved further off, and the observer will wonder why the separation did not strike him at first. A similar apparent increase of distance takes place by continued observation of close double stars through a telescope.

GREEN ICE.

BY HENRY J. SLACK, F.G.S.,

Member of the Microscopical Society of London.

It is sometimes worth while to remark upon a subject that may appear common-place, and I am induced to say a few words upon the often-noticed phenomenon of ice being coloured green by its enclosing confervoid vegetation, simply upon the ground that as it has lately interested me, it may interest other constant readers of the Intellectual Observer. During the severe frost of January, I was walking, on a clear sunny day, in company with a friend, when our attention was drawn to the brilliant green tint of sundry masses of ice scattered over the frozen surface and about the margin of a pond, on the Lower Heath, Hampstead, near the queer looking edifice dedicated to the water gods of the place. A man was amusing himself with a pickaxe breaking up the ice near one end of the pond, and scattering the fragments about him. Some he sent whizzing along the frozen water, and its surface was soon variegated by masses that gleamed with a beautiful beryl tint. Taking up some of these pieces I was struck with the small quantity of green matter that sufficed to tinge a considerable block, and as the cold was intense, I put a fragment in the pocket of a large great coat, just wrapped in a piece of paper, and thus carried it home nearly dry. Placed in a white porcelain vessel in my study it soon thawed, and at the bottom of the water was a little green stuff, which microscopic examination showed to consist of a minute oscillatoria, and some other conferva of which I don't know the name. These little plants seemed quite alive, as a high power detected no sign of decay in their bluish green chlorophyll; but their life processes must have been comparatively quiescent, as they remained for some days at the bottom of the vessel. Had they been active I presume they would have evolved enough air-bubbles to have caused them to float. A few days afterwards I went for a fresh supply, and found every piece of ice I examined very irregular in structure, and full of cavities I took for air-bubbles. A pocket lens showed the parallel planes of freezing very prettily, but did not detect any cavities round the conferva, which was disposed in minute tufts—not at all close together. I did not in any case see any conferva in an air-bubble, or any distinct air bubble attached to a conferva. Some masses of ice of an intense beryl green were broken with a hammer, and it was curious to remark how very small a quantity of the vegetable matter, distributed as I have described, tinged the whole

mass. The colour rapidly diminished as the lumps were reduced in size, and fragments an inch or two square only showed the tint where the little patches of converva actually occurred. In some instances the vegetation was somewhat more plentiful, and then the ice had to be reduced to still smaller pieces before the green hue disappeared.

I brought home several fragments of the ice in a bottle, but as the weather was not so cold as on the former occasion, about one third melted as I came along, and probably the condition of the solid masses was changed. Small pieces were placed on a strip of glass on the stage of the microscope, and examined with a three-inch object-glass, the light being thrown up strongly by means of the concave mirror. Under these circumstances the ice appeared anything but homogeneous. There were lots of bubbles, and a great confusion of optical surfaces, bounding portions of different density, and portions to which the crystalline structure gave a difference of refractive power. The conferva seemed closely surrounded by unfrozen water, and here and there a little air-bubble appeared, touching the delicate green threads. Was the conferva left in a little water-drop when the gelation took place, or, when thawing began, did it take place first round the delicate plants?

In his *Heat Considered as a Mode of Motion*, p. 318, Professor Tyndal gives a very interesting account of little water chambers, with air-bubbles in them, which he found in Norway ice, and he proved that they had been occasioned by melting minute portions of the block. "If," said he, "the liquid is the product of melted ice, its volume must be less than that of the ice that produced it, and the associated air-bubble must consist of rarified air." To test this, he melted some of the ice in warm water, and found the air-bubbles shrink in volume at the moment the surrounding ice was melted. In another experiment he placed a portion of ice in a freezing mixture, and froze the water-blebs. The ice thus treated "was immediately placed in a dark room, where no radiant heat could possibly affect it, and examined every quarter of an hour. The dim frozen spots gradually broke up into little water parcels, and in two hours the water-blebs were perfectly restored in the centre of the slab of ice. . . . . Hence no doubt can remain as to the possibility of effecting liquefaction in the interior of a mass of ice by heat which has passed by conduction through the substance without melting it." Thus the existence of water-blebs in ice does not prove that they consist of water left unfrozen when gelation took place; and I am disposed to think that the conferva threads were, as they looked under a hand-magnifier of low power, closely surrounded by frozen water, but not frozen themselves, because their cell contents

may demand, in order to be frozen, a somewhat lower temperature than that in which the water solidifies. When the mass of ice became warmer, and its outside was actively thawing, I imagine the conducted heat was arrested by the conferva, and thus the water-blebs round it gradually formed. If this were the case, the minutes air-bubble which I saw in some instances attached to the conferva, should have collapsed as the ice surrounding it thawed. I had not the means of ascertaining this, but the escape of the larger air-bubbles was a pretty sight when a lump of the ice was placed in a tumbler of warm water, and the melting process watched under a lens.

I believe Ehrenberg ascribed the escape of animalcules from being frozen to death when the water in which they lived congealed, to the action of their vital heat; but it seems to me more probable that they escaped because their vital fluids differed sufficiently from water to freeze at a lower temperature. Professor Tyndal, in the work cited, observes that there "seems no such thing as perfect homogeneity in nature. Change commences at distinct centres, instead of being uniformly and continuously distributed. . . . . The melting temperature of ice is set down at 32° F., but the absence of perfect homogeneity, whether from difference of crystalline texture, or some other cause, makes the melting temperature oscillate to a slight extent on both sides of the ordinary standard." It may be that slight variations from that uniformity of condition which is described by the term "homogeneous," causes some particles of water to freeze quicker than others; and if so, we may imagine how slight a divergence in the molecular condition or composition of a fluid, from the condition and composition of water, may enable the liquid contents of a plant or animal to retain their fluidity when the water in which they are immersed takes the solid form.

The question of why so little green stuff deposited in patches considerably distant from each other, gave so deep a tint to the ice of my experiments, may perhaps be answered by reference to its heterogeneous structure. There must not only have been refractions but also reflexions in all sorts of directions, from crystalline surfaces in various planes. Thus I conceive the effect of a very little green stuff was made to go a great way. The explanation may not be correct, but I can think of no better, and perhaps the remarks I have thrown together may suggest observations and experiments to others, who may witness appearances of the same or a similar kind.

CLUSTERS AND NEBULÆ.—DOUBLE STAR.—GREAT NEBULA IN ORION.—COMPARISON OF SUN AND STARS.—OCCULTATION.

BY THE REV. T. W. WEBB, M.A., F.R.A.S.

8. *The Great Cluster near Propus,* alias 35 M. *Prŏpus* is the name given by the ancients to a small star, preceding the foot of the Twin, Castor, as its meaning implies, whose present appearance is so far from warranting any special designation that one might suppose it had declined in brightness. It may be found thus:—A line from ζ *Tauri* to *Pollux* will be nearly bisected by a considerable 3 mag. star, ϵ *Geminorum*. Between ζ and ϵ will be seen three others, which form a line pointing *n p*. The uppermost and smallest, 5 mag., is *Propus,* alias 1 *Geminorum* in Flamsteed's nomenclature, being the first star of that constellation as to right ascension comprised in his catalogue. A little *n f* from this star the naked eye perceives a faint white cloud, a *nebula proper,* unnoticed however by the ancients, though they called the head of Orion "stella nebulosa," and discovered by Messier in 1764. The finder shows us a starry nebula, which in the telescope is expanded into what Smyth calls a gorgeous field of stars, from 9 to 16 mags., less rich in the centre, with a tendency to curved arrangement. It is thus described by Lassell, as viewed with his 24-inch speculum, in the Maltese sky, 1852:—"A marvellously striking object. No one can see it for the first time without an exclamation. Power 160; the field of view 19′ in diameter, and angular subtense" (or apparent extent), "53½′, is perfectly full of brilliant stars, unusually equal in magnitude and distribution over the whole area. Nothing but a sight of the object itself can convey an adequate idea of its exquisite beauty. The brilliancy and concentration of the stellar points and the blackness of the ground cannot otherwise be shown in their just contrast." The possessors of smaller apertures must of course not expect to witness such a spectacle; yet it is a noble object in any telescope. To do justice to its wide extent we must employ a very low power; but a higher one will best bring out its finest feature, a slightly curved arc or festoon of stars, depending, when inverted, and in the eastern sky, from a larger one at each end. The chord of this arc, which lies *n f* and *s p*, continued for three or four times its length in the latter direction, will point out a small faint nebula among the outliers of the great cluster, unnoticed in the Bedford Catalogue, but entered in that of Sir W. Herschel, where it is 17, VI.; and in that of Sir J. Herschel, who numbers it 375, and calls it "rich,

middle compressed almost to nebulosity, stars very small, irregular triangular figure." I found it visible with a comet-power of 29, and resolved into stars with 164, having then somewhat of the aspect that its brilliant neighbour has in the finder.* There is something very striking in the juxtaposition of these two objects; the one viewed, at an inconceivably greater remoteness, as it would seem, through the straggling components of the other, but both, perhaps, of similar constitution and arrangement. The earlier ideas of Herschel I. as to the construction of the heavens would have led us to suppose that if we could travel with the velocity of light to the nearer of these clusters, we might still find the second no larger or brighter than the first now appears to us, while our own sun behind us, and all his attendant system, had faded into one of those minute points, whose aggregation alone renders them perceptible to the unaided eye. But further discoveries have thrown doubt upon these speculations, which, however magnificent, were premature; and we are now obliged to admit that with regard to absolute and relative distances in the starry heavens our data are few,—our fully reliable ones fewer still.

The neighbourhood of these clusters is rich and beautiful, being a portion of the galaxy. *Propus* itself, a yellow star, is closely preceded by a pretty 9 or 10 mag. triplet, combined with still smaller points; some way further in the same direction is an interesting group, and *n* of this latter a fine open pair, about 7 and 7½ mag. *η Geminorum*, an orange star, the next visible to the naked eye *s f Propus*, will guide us to a very remarkable coloured star, less than 1° *n p*. It is 6 *Tauri*, marked 6 mag. in the S. D. U. K. maps, but very small for that class; its fiery red hue, like that of Antares upon a small scale, makes it an interesting object.

If we now pass up the galaxy a considerable distance from this region, we shall find, in an extended portion of it before we reach the bright star *Capella*, three clusters worthy of a search, which, however, must be the more careful as they are not in distinctly marked positions. We must first draw a line from *Aldebaran* through *β Tauri*, and then bend it a little northwards, in the direction of *Capella*; this will point out *θ*

* It should be noticed that these two objects, 35 M, and 17 H VI, though not their designations, have *changed places* in the larger maps of the S. D. U. K., which are, generally speaking, very free from error. While correcting the mistakes of others, I would beg permission to do the same by my own. I have subsequently ascertained that the aperture of the Greenwich object-glass, referred to in the No. for December, 1862, p. 374, is 11¾ instead of 12¾ inches; and in the description of the great Nebula in Andromeda, published in our number for December last, p. 349, where it is stated that no confirmation of the stellar symptoms showed by the Earl of Rosse's 3-feet speculum was known to have been obtained with the larger reflector, it should have been added, that in this instrument the nucleus has that granular appearance which indicates resolvability.

Aurigæ, a solitary 4 mag. star, in a conspicuous position, just across the galaxy. Rather more than half way from *β Tauri* to *θ Aurigæ*, and a little below the line joining them, we must sweep about for—

9. 37 M. (*Aurigæ*). A cluster which will appear as a nebula in the finder, and in a low power eye-piece will open out into a beautiful irregularly circular cloud of minute stars of various magnitudes, melting away on every side into the surrounding galaxy. Long gazing seems to bring out more perfectly the exceeding beauty of this glorious work of the Creator. It also bears higher powers well, with which it occupies the field. Smyth truly describes it as a magnificent object, the whole field being strewed with sparkling gold dust, and the group resolved into about 500 stars, from 10 to 14 mag., besides the outliers. He does not, however, mention a brighter star pointed out by Knott in a conspicuous position near the centre of the cluster. It is probably, as the latter says, an illustration of the fact, that what strikes one person does not strike another.

As much above as we have been looking below the line joining *β Tauri* and *ϑ Aurigæ*, and not far from our last object, a little sweeping will bring a luminous cloud into the field of the finder, which is—

10. 36* M. (*Aurigæ*). A large, bright, scattered cluster, 8′ to 14 mags., containing a double star, 368 H, 12″, 308·7, 8 and 9, both white.

If we place this object at the bottom of the field of the finder, we shall (if it is of an ordinary extent) perceive another less prominent nebulosity *n p*. This is

11. 38 M. (*Aurigæ*). Described by Smyth as a rich cluster, of an oblique cruciform shape, with a pair of large stars in each arm, and a conspicuous single one in the centre. It is best seen with a low power, and melts away into the surrounding galaxy. The neighbourhood is magnificent. A little *s* is a small cluster, 39 $\frac{H}{2}$ VII, *alias* 354 H., who calls it pretty rich, counting in it 50 or 60 stars, 9 to 12 mag.: such was the working of his 18-inch speculum on this comparatively feeble and remote aggregation.

Descending the galaxy for a considerable distance, and passing our acquaintance *Propus*, we shall find a much older acquaintance, 8 *Monocerotis*, No. 101 of our Double Star List (Int. Obs., 1863, April, p. 217). About 2° E. of this, the naked eye will readily detect a nebulosity, which the finder will turn into a starry cloud. It is—

12. 2 $\frac{H}{2}$ VII (*Monocerotis*). A brilliant group, containing stars from 7 to 14 mag—the latter, Smyth tells us, running in

* Wrongly numbered 56 in the maps of the S. D. U. K.

rays. It is 392 H. who calls it a large, poor (that is in numbers), but brilliant cluster. A very large field is required to do it justice, which will include towards its *s f* edge 12 *Monocerotis*, 6 mag., a fine yellow star.

If we go lower still towards the horizon, till we reach a line joining *Procyon* and *Sirius*, about one-third of the distance from the latter we shall detect by sweeping, a nebulous patch in the finder—

13. 50 M. (*Monocerotis*). A low power will here show us what Smyth justly calls a superb and very rich object, composed of stars from 8 to 16 mag., with spots of splendour indicating yet further masses. H. gives it a diameter of 10′ to 12′, and says the stragglers extend over a circle of 30′, as large as the moon. The mode in which it loses itself every way in the surrounding galaxy is very beautiful, as well as suggestive with regard to the constitution of that wonderful zone. The whole neighbourhood is superb, and will be swept over with a delighted gaze, minute sparklings breaking out throughout the whole extent of the field, and indicating the starry nature of the nebulous ground which fills it. A very moderate aperture, even under four inches, will suffice to indicate this resolvability, which will increase with every increase of light, till in the field of the great reflectors of Herschel, Schröter, and Lassell, the multitude of faintly-glittering points would prove that the whole of this vast stratum encompassing us on every side, is composed of stars: and every one of these literally millions of minute stars is a witness of the omnipresence and omnipotence of its Creator.

We will now turn to

14. *Præsepe* in *Cancer* (44 M). This celebrated cluster, which was well-known to the ancients, has been already referred to under No. 5 of our Double Stars (Int. Obs., I. 277), and may probably not be a stranger to us; however, it could not with propriety be omitted from the present list. It offers a perfect example of the process of nebular resolution, being barely resolvable without the telescope,* showing its components in the finder, and being widely opened out with high powers, while the reverse of this operation enables us readily to comprehend how clusters, fully separated to the naked eye, would become gradually compressed, and at length nebulous, if progressively removed to greater depths in space. The whole of Præsepe is too extensive to be included in an ordinary field; it is sub-divided into several groups, among which,

* Arago says, "It is impossible for mere unaided vision in any instance to separate" the stars. Their existence may, however, be recognized with little difficulty, giving a sparkling character to the mass. I have found the cluster much brighter by oblique vision.

pairs, triplets, and more complicated arrangements will be found. Two beautiful little triangles will be sure to attract notice.

DOUBLE STAR.

We shall meet with a beautiful object well worthy of being added to our former list by looking first for a considerable 3 mag. star, γ *Geminorum*, which lies between *Pollux* and *Betelgeux*, but nearer to the latter. A little *s f* from this star we shall notice two of the 4 and 5 mag., very near together, ξ^1 and ξ^2, and *s* again from these, a little *p*, another: this is the star of which we are in quest.

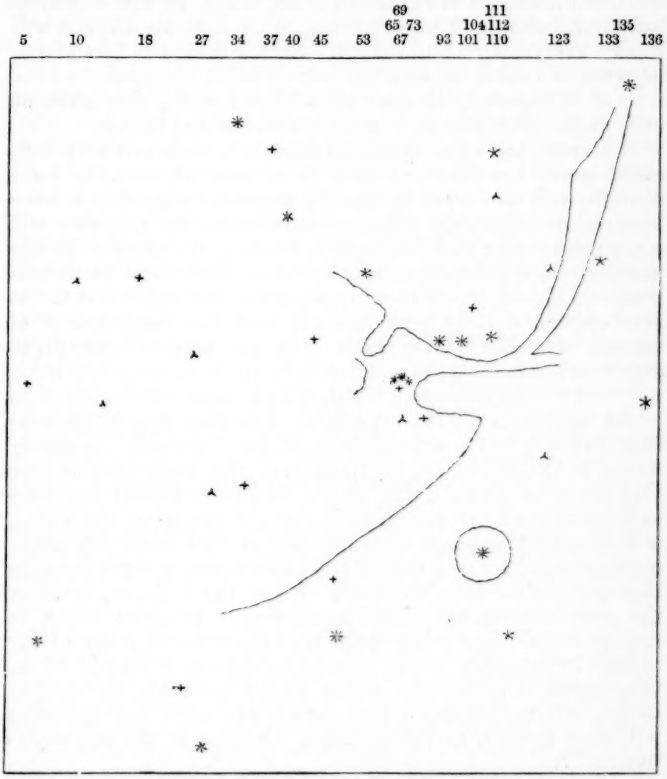
120. 15 *Monocerotis*. 2″·5. 206°·2. 6 and 9½, greenish and pale grey. This fine and easy object is converted into a triple group by the addition of a minute *comes*, which Smyth calls blue, at 15″ and 15°. He assigns to it only 15 mag., but I have found it more visible than I should have expected, being steadily seen with 5½ inches and a high power. Another still more minute attendant, unnoticed by Smyth, lies at a greater distance in the *n p* quadrant. Just *s* of the principal star, three other small pairs form an irregular transverse line across the field, and further in the same direction we shall find a fine group, requiring a low power. Many parts of this galaxy region are very glorious.

THE GREAT NEBULA IN ORION.

So lengthened a description of this nebula was given upon a former occasion, that some explanation seems requisite to account for its re-introduction at the present time. It is simply the result of a closer acquaintance with this great marvel of the heavens. A more careful telescopic examination of it than I had ever previously attempted, combined with a more extended comparison of the principal drawings of our great observers, has led me to think it an object worthy of much more, even at the hands of amateurs, than a passing gaze of wonder, and capable of repaying their diligent study and careful delineation. The discrepancies with regard more especially to the internal distribution of the luminous haze, as represented by our best observers, and by means of the finest instruments, are so obvious, that I feel less disposed than I should otherwise have done, to reject my own results, or think lightly of those of others, my fellow students, on the mere ground of their differing in some respects from all that has preceded them. Where the highest authorities differ, there is room for every man's independent work; and in such a case the aspiring sentiment of Tycho Brahe may be applied without diminution of the veneration with which we ought always to regard our masters in science:—

"Anne ita decet nos serviliter addictos aliorum prolatis, ut nihil in his ipsimet experiamur?"

A few favourable nights have shown me details which I know not how to reconcile with any designs which I have had an opportunity of examining, and there is reason to suppose that a similar examination in other hands would lead to analogous, though, very possibly, not identical conclusions. The feebler portions of the nebulosity are of course out of the reach of any but the most light-grasping instruments; but



[The figures placed above and beneath the diagram are the numbers by which the stars are designated, in the order of their Right Ascension, by Sir John Herschel, in his Observations at the Cape of Good Hope, and which have since been generally adopted. They are not introduced in the diagram for the sake of clearness, but they may easily be referred to their places by running a vertical line from each star to its corresponding number, above or below. The diagram is to be considered as bisected from right to left, just beneath the trapezium, the numbers at the top referring to the stars lying above the group, and *vice versa*.]

experience has led me to believe that a much smaller aperture than that of ten inches specified by O. Struve, as quoted in my former paper, is competent to deal with a fair proportion of its most remarkable features, and that many of our readers might find it highly interesting to make it matter of careful examination, and to record what they see for future comparison. To prepare for this by a wholly independent process of mapping out the included and attendant stars, would be not only very laborious, but a great waste of time, when a simple diagram will supply everything of the kind. Such a design is here given, inverted of course to suit the astronomical eye-piece; and a copy of it, especially if upon an enlarged scale, will serve at once as the groundwork of a delineation of the nebula.

The stars are by no means all that are visible with a $5\frac{1}{2}$-inch object-glass, but they are such as seemed at once the most obvious and the most favourably situated; some pains have been taken with their relative magnitudes, but accuracy will not be expected; and the lines indicating the position of the nebulosity are inserted merely for more convenient identification, and should be omitted in preparing the copy for use. It may require a little perseverance, and the employment of various magnifiers (even high ones not being excluded), to make out the boundaries and details of the hazy mass, but habit will soon render its aspect familiar, and more intelligible than might have been at first expected. Attention may be particularly directed to the arrangement of the "flocculi," or cloudy wisps, in the bright region lying S. of the trapezium, as here they are most distinct, and appear to me to exhibit the least agreement with the published designs of our great observers; and should the attempt at delineation at first seem difficult or uninteresting, we may call to mind that within a short time, on this spot rather than anywhere else in the heavens, is one of the most remarkable of all astronomical enigmas likely to receive its solution—what is the true character of many of the nebulæ? Are they merely remote collections of stars? or are they luminous mists, of a nature wholly unknown, and subject to internal movements whose causes are now, and probably will ever remain, as Seneca says, "hidden in the majesty of nature"?

COMPARISON OF SUN AND STARS.

The celebrated American optician, Alvan Clark—whose gigantic $18\frac{1}{2}$-inch object-glass, after receiving the Lalande prize of the Académie des Sciences, has recently been purchased by the Astronomical Association of Chicago for 11,187 dollars—has published an interesting account of his photometric experiments on the comparative brightness of the sun and the fixed stars.* Starting with the acknowledged optical fact, that

* *The Sun and Stars Photometrically Compared.* By Alvan Clark. 1863.

the focal image produced by a convex lens corresponds in apparent magnitude and brightness with the original object when viewed from a distance equal to the focal length of the lens, and diminishes in proportion as the distance of the eye increases, he proceeds to apply it experimentally in the following manner:—Having an underground dark chamber, 230 feet in length, communicating at one extremity with the open air by a vertical opening, he first reflects the sun's rays down this opening by an ordinary mirror, and then gives them a horizontal direction by means of a reflecting prism, on the inner face of which is cemented a little convex lens of $\frac{1}{20}$ of an inch focus. When the solar light is transmitted through this apparatus, an observer at the other end of the long gallery sees it reduced 55,200 times, in which condition its appearance differs but little from that of Sirius. The intention, however, being to obtain not a comparative but an absolute reduction to the *minimum visibile*, or the equivalent of a faint 6 mag. star, another lens of 6 inches focus is interposed between the eye and the minute lens, and made by means of cords to traverse the long chamber at the observer's pleasure, till the solar image, thus doubly diminished, is on the point of disappearance. The reduction obtained in this way, amounting to 1,203,360 times, indicates that the sun, at that distance, would be only just visible to the unassisted eye; while at 100,000 times his present distance, he would merely rank as a pretty bright first-magnitude star, though his parallax would be double that assigned to any star in the whole heavens. And hence he draws the following conclusion:—"If the distances imputed to several of the stars from parallax can be true, I am sure those having the taste, talent, and leisure necessary for following up photometrical researches with efficiency, cannot fail to find our glorious luminary a very small star; and to the human understanding, thus enlightened, more than ever must the heavens declare the glory of God." In confirmation of this result he subsequently removed the 8-inch object-glass from the tube of his equatoreal, and turned the eye-end to the sun, carrying two lenses of $\frac{1}{20}$th and $\frac{1}{34}$ th of an inch focus, at an adjustable distance from each other, and thus found, when his face was inserted in place of the object-glass, a reduction of about 1,308,000 times necessary to obtain the *minimum visibile;* a result sufficiently accordant with the former, when the very delicate nature of the investigation is considered. In the interesting paper, of which this is an abstract, the ingenious author has taken into account the loss of light in reflexion, and its increase from the strongly illuminated neighbourhood of the sun; and seems to have used every precaution in the conduct of his experiments. He adds that a similar mode of reduction brings the star Castor to the same point at a distance repre-

sented by 10·3; Pollux 11; Procyon 12; Sirius 20; the full moon 3000; whence it appears incidentally that it would take the light of 400 moons to equal that of the sun—a result very different from those hitherto obtained, which are however altogether discordant among themselves. Bouguer, for instance, gave the proportion 300,000; Robert Smith 90,000; Lambert 277,000; Wollaston 801,072. In speaking of a somewhat similar case, Sir John Herschel has observed that "discordances of this kind will startle no one conversant with photometry." But they evidently imply the necessity of further research: and whatever may be the comparative value of Mr. Clark's experiments (which could hardly have been undertaken by a more competent observer), they must be acknowledged to be an important move in the right direction.

OCCULTATION.

A single occultation only will be conveniently visible during the month of February. 20th, 60 Cancri, 6 mag., will disappear from 6h. 32m. to 7h. 34m.

PROCEEDINGS OF LEARNED SOCIETIES.

BY W. B. TEGETMEIER.

ENTOMOLOGICAL SOCIETY.—*Jan.* 4.

Introduction of White Ants into St. Helena.—A communication was read from the Lords of the Admiralty requesting the advice of the society as to the best means of securing the destruction of the white ants which had been introduced into James Town twenty years since, from the Coast of Guinea. Since which time they have multiplied to so great an extent as to have seriously injured every building in the town, and to have reduced some to such a state of ruin as to compel the inhabitants entirely to abandon them. General Sir John Hearsey related his experience respecting the white ants in India, and stated that if they once gained access to a house their eradication was generally regarded as impossible, unless the house was taken down and rebuilt. He suggested the steeping of the timber in a solution of quick lime; but as this would rapidly become converted into carbonate of lime by exposure to the air, it does not offer much promise of success. For small articles General Hearsey recommended a solution of corrosive sublimate. Mr. H. W. Bates, who has had much experience respecting these insects in the forests of South America, stated that they did not attack houses, furniture, or store boxes, constructed of a very hard wood called Acapù, and that it was customary to protect boxes, etc., of softer wood by raising them on blocks of acapù. When

the ants had gained possession he found that they might be expelled by the free use of the arsenical soap employed in preserving animal skins. This soap, which is a compound of common soap, carbonate of potash, and white arsenic, is made into a lather with water, and brushed over the articles which it is wished to preserve. The great objection to such a proceeding is obviously the danger to the health of the inhabitants from the dissemination of the arsenic into the atmosphere.

Mr. Robinson stated that the ravages of the white ants on the sleepers and other wood work of the East Indian railways had been entirely prevented by the use of creosote, but the exceedingly objectionable odour of this remedy would prevent its being used in a dwelling-house.

PHARMACEUTICAL SOCIETY.—*Jan.* 6.

Preparation of Essential Oils.—Mr. T. B. Groves suggested an exceedingly ingenious method for the separation of essential oils from watery solutions in which they exist in small quantities, such solutions being frequently produced by the distillation of aromatic herbs, etc.

A proportion of olive oil is added to the aromatic solution; this is then formed into a soapy emulsion by the addition of potash. When this emulsion is destroyed by the addition of an acid, the olive oil rises to the surface, bringing with it all the aromatic oil, which may then be readily dissolved out of the fatty oil by agitation with rectified spirit.

LONDON INSTITUTION.—*Jan.* 20.

Sources of the Nile.—Dr. Beke delivered a lecture on the Sources of the Nile, in which he demurred altogether to the conclusions of Captains Grant and Speke, as to the origin of that river in the Lake Victoria Nyanza. Dr. Beke maintains that the Nile merely flows through the Nyanza Lake, its true origin being in the Mountains of the Moon, which run from north to south parallel to the east coast.

The mountains laid down by Captain Speke at the northern extremity of the Lake Tanganyika, are stated by Dr. Beke to be entirely imaginary.

Dr. Beke stated that Captains Grant and Speke had left a most important part of the river unexplored, namely, a large bend that extended for at least 200 miles, and that in this portion there was a fall of 1000 feet, which had not yet been examined or explained. The true source of the Nile Dr. Beke maintained to be the range of snow mountains on the eastern side of the Nyanza Lake, a district unexplored by Captains Grant and Speke's expedition. The maps exhibited by Dr. Beke showed that the recent explorations proved the correctness of the theories he had submitted to the Geographical Society in 1849, and he proposed to undertake again in person the command of another expedition, which would be

confined entirely to the south side of the equator, as the northern part of the river is being investigated by Madame Tinne's party, which includes several scientific observers, as the Baron Von Heuglin.

LONDON MICROSCOPICAL SOCIETY.

HELD AT KING'S COLLEGE, *Jan.* 13.

Charles Brooke, Esq., President, in the Chair.

Dr. Lionel S. Beale read a very interesting paper on the white blood corpuscles, after which a very animated discussion took place, in which the President, Dr. Carpenter, Mr. A. Brady, Mr. Samuelson, Dr. Beale, and Mr. H. Lobb, took part. The discussion was chiefly between Dr. Beale and Dr. Carpenter, and elicited considerable applause from the meeting.

A new table for heating slides while mounting was exhibited by Mr. D. Everett Goddard, and which is certainly a great improvement on those previously in use. Instead of heating the slide by placing it on a flat metal, the table is so constructed that the centre of the slide is heated by radiation, and the balsam in which the preparation is mounted does not come in direct contact with the hot metal plate.

NOTES AND MEMORANDA.

RECENTLY NAMED LUNAR CRATERS.—Mr. Birt, of Hartwell Observatory, has communicated to the *Astronomische Nachrichten* the following notes on craters he has recently named.—405, 406. The Coxwell Mountains skirt the S.W. edge of Palus Somnii, Mount Glaisher being the culminating point just south of Proclus. 407. Chevallier. A full-sized crater near Atlas. It is rather shallow, and has some formations within. 408, 409. Moigno and Peters are two somewhat similar and rather conspicuous craters when the Terminator is near them. They are in the neighbourhood of Christian Mayer. 410. The Teneriffe Mountains are the detached rocks on the Mare Imbrium, south of Plato. They are respectively designated Petora, Guajara, Pico, Rambleta, Alta Vista, and Chajorra. The remarkable range between Plato and La Place is provisionally called "Straight Chain." A chart of the Teneriffe Mountains is in project. 411. Piazzi Smyth. A small crater near Kirch, it is between Petora and Guajara. 412 to 415. Herschel II., Robinson, South, and Babbage form a fine group hitherto unrepresented as they appear in our lunar maps. An account of this group will be found in the "Report of the British Association for the Advancement of Science, for 1862," page 9; Transactions of the Sections. 416. The Percy Mountains, extending from Gassendi to Cavendish, form a fine chain with crater openings. This chain is interrupted by Mersenius. 417. Rosse. A fine walled plain, hitherto unrepresented. 418 to 421. J. Franklin, Crozier, and MacClure form a bold headland, projecting with the Mare Fecunditatis opposite the Pyrenees. 422. Wrottesley. A crater eastward of and adjoining Petavius. 423. Phillips. A large crater adjoining Wilhelm Humboldt. It is lettered "Humboldt," in Beer and Mädler's, and also in Le Couturier's maps; but the large crater rather west is really W. Humboldt. Beer and Mädler describe it as such. 424. The Mare Smythii, named Kästner by Schröter, but very imperfectly represented by Beer and Mädler, as to require some change. The numbering is carried on from the Rev. J. W. Webb's catalogue in his very useful work, *Celestial Objects for*

Common Telescopes. Those localities marked (412, 3, 4, 7, 24) are unrepresented in Beer and Mädler's large map, but some very imperfect indications of them exist. The authority for the Selenographical Co-ordinates is Beer and Mädler's map. They however require a careful redetermination. It is proper to add to this list "Le Verrier," the name given in Le Couturier's map to Beer and Mädler's Helicon A. in N. lat. 40° 11′ and E. long. 20° 25′.

Snow Fall and Wind Storms.—Marshal Vaillant says that the storm from which the fleet suffered in the Black Sea, in November, 1854, was caused by a heavy snow fall on the Caucasian Mountains. He imagines that the storm of 2nd and 3rd December, 1863, may have arisen from a great snow storm in Scotland, producing intense cold, that acted on the warm south wind that was prevalent in Europe. Such snow storms might doubtless exert such an effect, but is there any evidence that a sufficient snow fall did occur in Scotland at the time?

Human Fossils from Bruniquel.—M.M. Garigon, Martin, and Trutat describe in *Comptes Rendus*, two fragments of human jaws discovered in the cavern of Bruniquel (Tarne et Garonne). This cavern is in a Jurassic limestone, and the soil found in it is formed by the superposition of several layers, which the writers examined at a depth of three metres. First was a stalagmite deposit of 22 centimetres; then an osseous breccia 1m. 48; then black clay beds repeated several times, in the midst of which was a *pell mell* of wrought flints of all known shapes; barbed arrow points; bones of carnivores, ruminants, and birds, and rounded pebbles. The writers remark that "the reindeer is characteristic of the age of this cavern, and that bearing in mind the four divisions established by M. Lartet for the quaternary epoch, we see at once that it is to the third palæontological epoch that we must refer the filling up of this excavation." The two human jaw fragments were found in the presence of several witnesses, at a depth of about two metres, in a bed of clay, containing quantities of charcoal, wrought flints, and bones of ruminants. After various anatomical details, the writers observe—"Three human jaws are thus referred to the same type—brachycephalic—although they belong to epochs completely separated one from the other; that of Aurignac, with which was found the *Ursus spelæus;* that of Moulin Quignon bedded with *Elephas primigenius*; and that of Bruniquel lying in the midst of bones of the reindeer." Amongst the bone fragments of this cave was found the humerus of a big bird, on which was roughly sculptured different parts of a fish.

Are Different Bodies Luminous at the Same Temperature?—M. F. de la Provostaye details in *Comptes Rendus* a process of theoretical reasoning, by which he arrives at the conclusion that different bodies progressively heated, do not become luminous at the same temperature.

Beale on Blood Corpuscles.—In a paper which will be found in the *Quarterly Journal of Microscopic Science*, Mr. Lionel Beale says—"It is most remarkable that the red colouring matter of the blood corpuscles of different animals should crystallize in different forms; and there are instances of animals closely allied to each other, the blood crystals of which are quite distinct; for example—the red colouring of the guinea pig assumes the form of tetra-hedra, while that of the squirrel crystallizes in six-sided plates, and that of the hamster in rhomboidal crystals." With reference to the condition of different portions of the blood, Professor Beale observes—"In man and in mammalia there are circular coloured corpuscles without a nucleus, and the so-called white or colourless corpuscles, which are spherical. Now I believe that the 'colourless corpuscles,' and the 'colourless nuclei' of the red corpuscles, consist of matter in a living state, while there are reasons for the conclusion that the coloured material has ceased to exhibit vital properties." While admitting that under certain circumstances the appearance of a cell-wall is produced, Professor Beale alleges various reasons for denying that such a structure is essential to a blood corpuscle. In concluding his paper he expresses his belief that "the red material is not living, but results from changes occurring in colourless living matter, just as cuticle, or tendon, or cartilage, or the formed material of the liver cell, results from changes occurring in the germinal matter of each of these cells. The colourless corpuscles, and

those small corpuscles which are gradually undergoing conversion into red corpuscles, are living, but the old red blood corpuscles consist of inanimate matter."

Lead Rings for Microscope Slides.—Mr. John Butterworth, of Moorside, near Oldham, writes to us that he cuts rings from lead tubes with a tenon saw, and finds them answer very well. Any inequality left by the saw can be removed by a file. Similar rings could easily be punched out of sheet lead of various thicknesses, but they would not be adapted for fluids, most of which would corrode them.

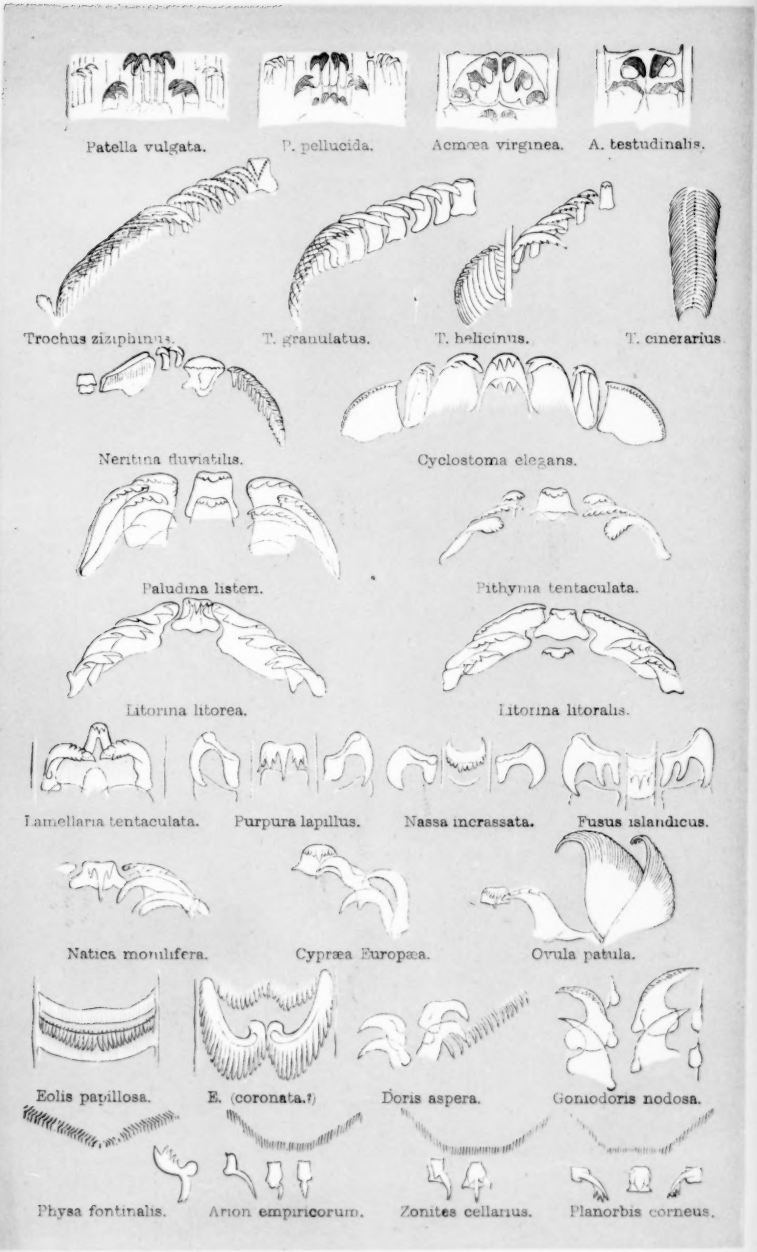
Mr. Glaisher's 12th January Ascent.—This ascent took place from the Arsenal, Woolwich, at two p.m., and the descent shortly after four at Lakenheath Warren, near Brandon. On the ground at starting the temperature was 42°, but at the height of half a mile it was nearly 4° warmer. At this height, Mr. Glashier had usually found it from 12° to 16° colder. The warm stratum of S.W. wind was fully 3000 feet thick. The greatest height reached was 13,000 feet, when the darkness and fear of drifting seaward rendered a descent prudent. At starting, dew was deposited at 35°; at 36°, between 1500 and 3000 feet elevation; and at zero, near 9500 was reached.

Strange Weather Fact at Milan.—We learn from the *Presse Scientifique* that on a date not given, although the sky was quite clear, the earth was covered with moisture, and the houses dripped as if drenched with rain. The supposed explanation is that the houses and soil had previously grown cold, and that a warm current of moist air was impelled against them. It is curious that no mist is reported as seen near the ground.

Loss of Memory.—"The celebrated Professor Lourdat, of Montpellier, was obliged to recommence his medical studies from the very beginning after terminating them with distinction, a typhoid fever having destroyed the fruits of five or six laborious years."—*Presse Scientifique.*

Sponge Spicules.—Dr. Wallich, in a paper on Mineral Deposit in Rhizopods and Sponges in *Annals of Natural History*, gives a new view of this subject, according to which, when a spicule is to be formed, a vacuole of similar shape makes its appearance in the sarcode, and its long axis is traversed by a thread of sarcode, which he calls a *vacuolar stolon*. The stolon and the walls of the vacuole each secrete a layer of silex, after which the stolon usually diminishes in size, and secretes fresh layers of silex to occupy the vacancy. Layers of silex may, however, in some cases be deposited externally, and to make room for them the walls of the vacuole must recede. The mode of growth he considers different from what takes place in the mineral deposits of rhizopods.

The Liverpool Explosion.—On the 15th January, at 7.25 p.m., the "Lotty Sleigh," containing about eleven and a half tons of gunpowder in 940 quarter kegs, blew up between Monk's Ferry and the Tranmere Slip, in the Mersey. The *Liverpool Post* described two distinct explosions; but three separate shocks were felt at Ross, where also the sound was heard. Tremendous air waves were produced at Liverpool and Birkenhead, bursting open strong doors that were locked and barred, smashing an immense quantity of glass, and putting out the gas lights. At Gloucester the shock was felt, and likewise at Blockley, in Worcestershire. The report was so loud at Chester, that the authorities telegraphed to Liverpool to know what was the matter. For many considerations belonging to such concussions we must refer our readers to the article on "The Philosophy of Earthquakes," in our number for December, 1863. We may add that Mr. Mallet found that the wave of the Neapolitan earthquake, which he investigated, travelled at the rate of 658·2 feet per second. How does this coincide with British experience in the Liverpool explosion shock? Perhaps the Ross observer felt the two shocks directly arising from the two explosions, and a reflected shock resulting from one or both.



PALATES OF MOLLUSCA.